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**Artificial Intelligence/Enemy Courses  
of Action (AI/ENCOA)  
User's Manual**

**Battlefield Information Systems Technical Area  
Systems Research Laboratory**

April 1987



**U.S. Army Research Institute for the Behavioral and Social Sciences**

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for evaluating different types of possible enemy courses of action. This report is a user's guide that contains an overview of the aid, a detailed demonstration of its operation, an explanation of the menu options, and reference material consisting of the background scenario for the demonstration and rationale for score assignment in the underlying model.

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# **Artificial Intelligence/Enemy Courses of Action (AI/ENCOA) User's Manual**

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**Office, Deputy Chief of Staff for Personnel  
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## FOREWORD

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A concern of the Army in recent years has been to provide improved support to tactical intelligence analysts who must deal with the increasing amount of complex information being generated by intelligence collection systems. In an initial step toward automated support for analysts, a prototype aid called ENCOA (Enemy Courses of Action) was developed. This aid was designed to assist the analyst with intelligence preparation of the battlefield by providing explicit procedures for organizing and integrating information pertaining to alternative enemy courses of action. The aid is based on a decision analytic methodology, multiattribute utility, which requires that the analyst input a large number of numerical judgments. In both formal and informal evaluations of the aid, these numerical judgments were reported as cumbersome and unnatural. Because the aid, otherwise, showed promise for assisting in the assessment of the enemy courses of action, a follow-on aid was developed. The aid, called AI/ENCOA, is the subject of this report. It uses both an underlying multiattribute utility model and rule-based procedures to provide a more natural, non-numeric interface. It consists of two components: a generic software package that implements the procedures, and two rule bases for evaluating different types of possible enemy courses of action.

This research was conducted within the Systems Research Laboratory under the project entitled, "Performance Aids for the Intelligence Analyst in Future Systems," and sponsored by the Army Intelligence Center and School in a Letter of Agreement dated 23 March 1984. COL W. Walters, Director of Combat Developments, and COL D. LeBlanc, Director of Training and Doctrine, were briefed on the results of the research in 1985. The product was accepted and utilized by the Combat Developers Support Group to assist in defining user interface requirements for new Intelligence and Electronic Warfare Systems.



EDGAR M. JOHNSON  
Technical Director

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## 1.0 INTRODUCTION

### 1.1 The Nature of AI/ENCOA

The Artificial Intelligence/Enemy Course of Action (AI/ENCOA) Aid is a software package designed to assist an Army tactical intelligence (G2 staff) officer in organizing and evaluating the impact of certain types of information. This information consists of available, relevant data concerning terrain, friendly forces, opposing forces (OPFOR), weather, and certain risk factors. AI/ENCOA helps the intelligence officer evaluate how much this information supports different courses of action or avenues of approach open to the enemy. It must be emphasized that AI/ENCOA does not replace a G2 staff officer; it is to assist the officer in a time-constrained, uncertain, decision environment.

Based on available information, the intelligence officer must answer a number of questions concerning the current tactical battlefield situation. The answers are used by AI/ENCOA to evaluate how much support exists for each of four possible enemy Courses of Action (COAs for "Courses of Action"; or ENCOAs or ECOAs for "Enemy Courses of Action"; all three acronyms appear both in the literature and throughout the present text). Here the four possible enemy COAs are:

1. Primary Attack;
2. Secondary Attack;
3. Defense; and
4. Withdrawal.

The analysis can be performed on a single division-wide sector or

on several division-wide sectors. It may also be used to analyze alternative enemy Avenues of Approach (AOAs) within a given sector after a determination has been made that there is strong support for a primary or secondary attack in that sector. The OPFOR doctrine models the Soviet doctrinal concepts evolved for conducting combat operations in a temperate climate, industrialized area. The applications window considered included France and the Low Countries and extended eastward into the Western Departments of the USSR. It is probably equally applicable in many portions of North America.

AI/ENCOA uses only the most key elements of information available to the division staff for planning. It is assumed that the 40 or so elements are the main considerations influencing the selection of the OPFOR course of action. As pointed out above, the model was designed to assist the division-level decision process. For lower or higher echelons a different set of factors would be considered at different levels of resolution. Moreover, since AI/ENCOA is a prototype, many enhancements can be made to improve it at some future date.

## 1.2 The AI/ENCOA User's Manual

The main part (Section 2) of the user's manual introduces AI/ENCOA by means of a demonstration. It is anticipated that users will be able to sit down at an IBM PC with this document in hand, turn to Section 2, and run through the demonstration. Section 3, "Compendium of Menu Options," is intended primarily for reference.

Two appendices are included. Appendix A, "Statement of the Demonstration Problem," reproduces the U.S. Intelligence Center and School memoranda defining the problem which is the basis for the

demonstration used in Section 2 to introduce AI/ENCOA. Appendix B, "Rationale for Score Assignment," gives, from a military perspective, the rationale underlying the assignment of the particular numerical values or "scores" used in the demonstration.

Two documents are companion volumes to the present one. The first is: "Combining Decision Analysis and Artificial Intelligence Techniques: An Intelligent Aid for Estimating Enemy Courses of Action." This document contains a discussion of the technical underpinnings of AI/ENCOA, including how to modify the rule base while leaving the rest of the program intact. The second is "Document of AI/ENCOA Knowledge Base and Source Listing". The latter document contains listings of the AI/ENCOA program and rule bases. Neither of these documents is necessary for running AI/ENCOA.

The user should always remember that AI/ENCOA was designed to assist the Army tactical intelligence (G2 staff) officer in organizing and evaluating information regarding (1) whether the enemy will attack, defend, or withdraw, and (2) if there is a great deal of support for an attack, what avenue of approach the enemy will take into the friendly division sector. In using AI/ENCOA, therefore, the user typically will go through the sequence of activities presented in Exhibit 1.2-1.

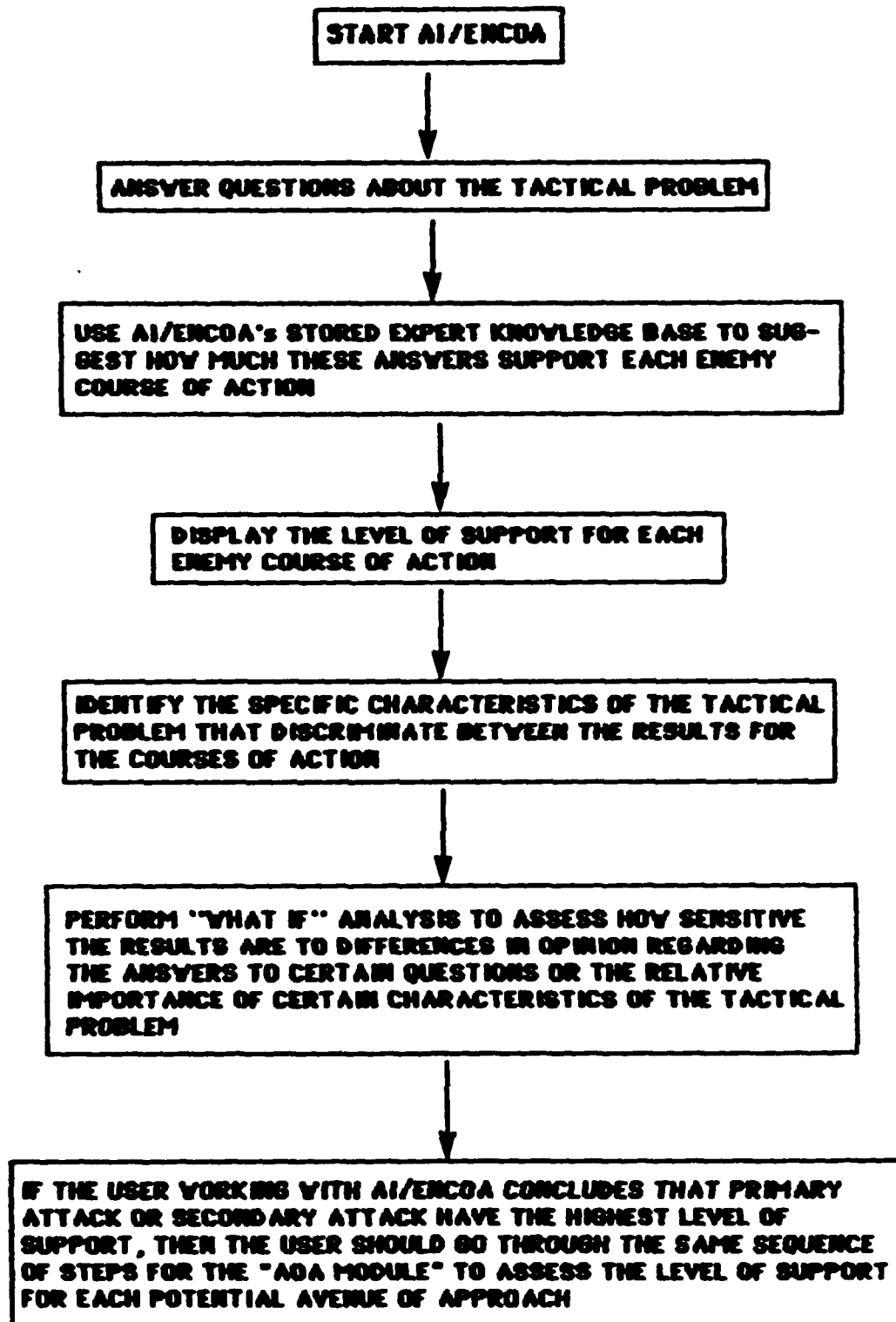


EXHIBIT 1.2-1

TYPICAL SEQUENCE OF ACTIVITIES INVOLVED  
IN USING AI/ENCOA

## 2.0 AI/ENCOA DEMONSTRATION

### 2.1 Introduction

Section 2.0 describes the AI/ENCOA demonstration and, in the context of the demonstration, tells how to use AI/ENCOA. In particular, the remainder of Section 2.0 is divided into the following subsections.

- Sections 2.2 and 2.3 tell how to start up the AI/ENCOA software package.
- Section 2.4 describes the AI/ENCOA Tutorial, which demonstrates in a step-by-step fashion, for a test scenario, how to use AI/ENCOA to assist in evaluating alternative enemy courses of action.
- Section 2.5 tells how to restore a previously saved answer set.
- Section 2.6 shows how to examine the hierarchy of factors used in analyzing and evaluating COAs.
- Section 2.7 tells how to go about answering questions relating to the current battlefield situation.
- Section 2.8 explains how to display textual, tabular, and numerical results.
- Section 2.9 explains how to analyze the results with discrimination ("What are the key factors?") or sensitivity ("What if?") analysis.
- Section 2.10 contains an AI/ENCOA evaluation of two AOAs that are related in subject matter to the COAs evaluated earlier.

Except for Starting Up (Section 2.2), and except as noted in the Exhibits themselves, the minimum instructions necessary for running and understanding the demonstration are contained in the text below the accompanying exhibits. The remaining text in Section 2 contains information that may be helpful, but not essential, to the reader.

## 2.2 Starting Up

The AI/ENCOA software described in this document was written in Turbo Pascal, Version 2.0, to be run on an IBM PC. The <PrtSc> option provided within AI/ENCOA has been customized for an Apple Model A2M0058 or similar printer; slight modifications to the code may be necessary to use this option with a different printer. Use of AI/ENCOA requires an IBM PC with a 10 megabyte hard disk and the two diskettes which are described in the next paragraph.

Begin the AI/ENCOA demonstration by turning on the machine. Insert the diskette marked "AI/ENCOA A:" into the disk drive and type "a:install". The disk indicator lights will light on both the floppy and the fixed disk drives. A list of files will print on the screen, then the system will prompt "Insert the diskette for Drive B: and strike any key to continue". Remove the current diskette and insert the diskette marked "AI/ENCOA B:" and then press any key. More files will be listed to the screen, and the system will prompt "Insert the diskette for drive A: and strike any key to continue". Reinsert the first diskette and press a key. When the system prompts "C>", type "aienco" to start the program. The "Title-page" AI/ENCOA display, containing the title "AI/ENCOA" and a statement of who developed the program and for whom, will appear.



NOTE: The following information about the IBM PC keyboard is included for the benefit of readers who may not be familiar with the machine.

An illustration of the IBM PC Keyboard is shown in Exhibit 2.2-1. It is reproduced from Page 2-8 of BASIC for the IBM Personal Computer, Part Number 6025010, International Business Machines Corporation, 1981. Numbers added to the Exhibit indicate keys which have a special significance for AI/ENCOA. A legend under the Exhibit states briefly what that significance is.

Note the following convention, used both here and throughout the rest of the document. "<A>" -- that is, the result of placing the letter "A" within carets -- is used to denote the IBM PC Keyboard key, or combination of keys, used to enter the letter "A". In this case, the key labeled "A" would have to be pressed while the shift key was pressed in order to enter an upper-case "A", under normal circumstances.

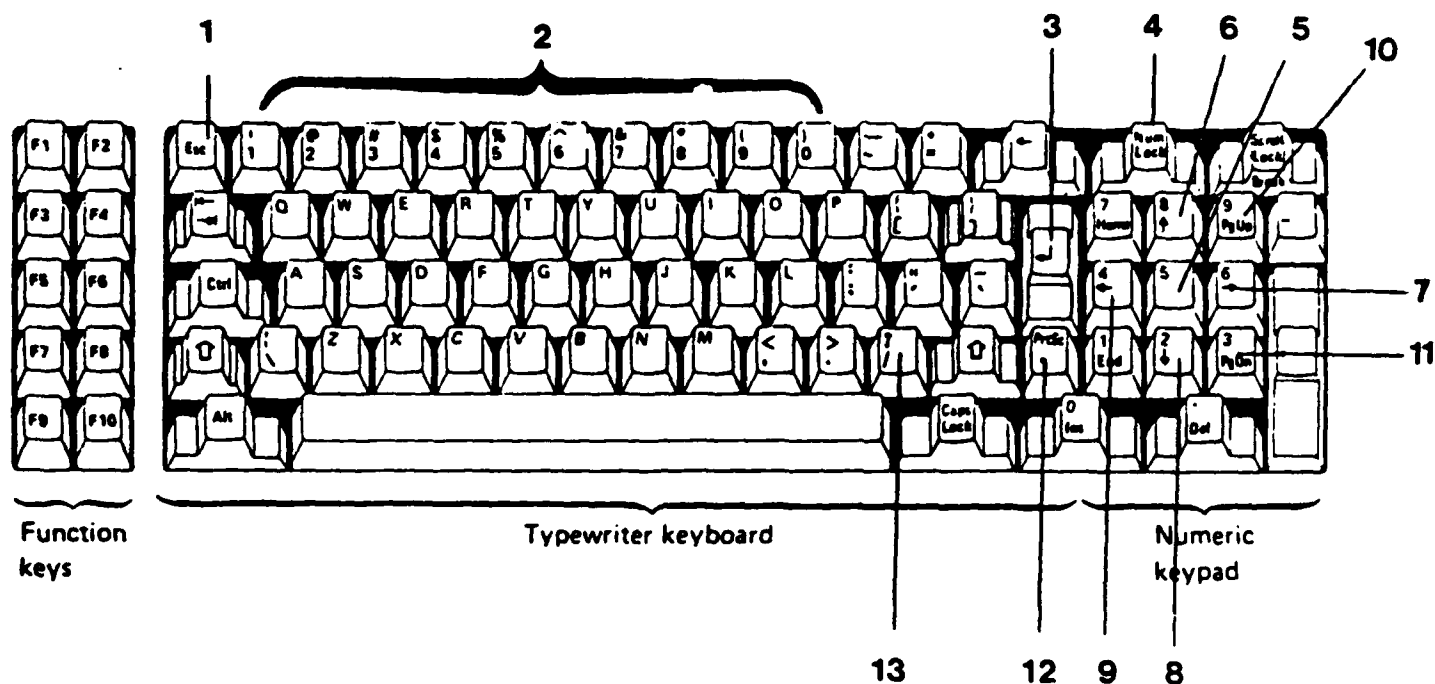


EXHIBIT 2.2-1  
SPECIAL KEYS USED BY AI/ENCOA

- 1 The "Escape" key, <Esc>
- 2 These keys are used to enter numbers (Do not use the keys on the numeric keypad)
- 3 The "Return" key, <Ret>
- 4 The "Num Lock" key, <Num Lock>
- 5 The <5> key (Used for setting the <Num Lock> key)
- 6 The "Cursor Up" arrow key < ↑ >
- 7 The "Cursor Right" arrow key < → >
- 8 The "Cursor Down" arrow key < ↓ >
- 9 The "Cursor Left" arrow key < ← >
- 10 The "Page Up" key <PgUp>
- 11 The "Page Down" key <PgDn>
- 12 The "Print Screen" key <PrtSc>
- 13 The "Help" key <?>

### 2.3 Setting the <Num Lock> Key

Starting from the "Title-page" display, press <Ret>, or any other key, and the second AI/ENCOA display, shown in Exhibit 2.3-1, will appear. The second AI/ENCOA display describes the use of the number keys (located on the top row of the keypad) and the <PgUp>, <PgDn>, and arrow keys (located on the numeric keyboard).

IMPORTANT: Be sure to set the <Num Lock>. Press the <5> key on the numeric pad. Did the upper part of the display disappear? If so, press the <Num Lock> key just once (the display will not change, but a single key click will be heard); otherwise, do nothing. From now on, use only the number keys on the top row of the keyboard to enter numbers in AI/ENCOA.

The number keys, located on the top row of the keyboard, are used to make menu selections.

When doing an analysis, the arrow keys, located on the right side of the keyboard, are used to move through the hierarchy of factors. When they are pressed a graph of the current portion of the hierarchy is shown.

When doing an analysis, the <PgUp> and <PgDn> keys, located near the arrow keys, are used to change the current ADA or Sector. When they are pressed, a list of the ADA or Sector names is shown.

Main Menu	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

#### EXHIBIT 2.3-1

##### SECOND AI/ENCOA DISPLAY

[The first AI/ENCOA ("Title-page") display is not included in the present Exhibits.]

Press <1> to enter the Tutorial Session.

See Exhibit 3-1 for a brief discussion of the other options shown on this menu.

## 2.4 The Tutorial Session

Enter the Tutorial session from the Main Menu by pressing <1> ("Present Tutorial"), as described in Exhibit 2.3-1.

The Tutorial session consists of 11 consecutive screens (Exhibits 2.4.1 through 2.4.11) displaying information about AI/ENCOA, followed by a twelfth screen having a blank upper part. The choices available to the user during the Tutorial are indicated at the bottom of each Tutorial display -- not by the choices given in the Main Menu.

If desired, press the <Esc> key to "escape" from the Tutorial and return to a point where one of the options listed in the main menu may be chosen.

The Artificial Intelligence / Enemy Course of Action (AI/ENCOA) aid is designed to assist an Army tactical intelligence (G2 staff) officer in organizing available, relevant information concerning terrain, friendly forces, opposing forces (OPFOR), weather, and certain risk factors in order to evaluate how much this information supports different courses of action open to the enemy.

AI/ENCOA does not replace a G2 staff officer. It is used to assist the officer in a time-constrained, uncertain, decision environment.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

-----	
-----	
-Main Menu-	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach
-----	

#### EXHIBIT 2.4-1

##### FIRST TUTORIAL DISPLAY

Here, and for every display within the Tutorial session, press <Ret> to continue.

AI/ENCOA requires you, the user, to answer a number of questions concerning the current tactical battlefield situation. The answers you provide are used by AI/ENCOA to evaluate how much support exists for four (4) enemy Courses of Action (COAs):

- 1) Primary Attack,
- 2) Secondary Attack,
- 3) Defense, and
- 4) Withdrawal.

This analysis can be performed on a single, division-wide sector or on several division-wide sectors. It may also be used to analyze alternative enemy Avenues of Approach (AOAs) within a given sector after it has been determined that there is strong support for a primary or secondary attack in that sector.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

-----	
-----	
-Main Menu-	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach
-----	

#### EXHIBIT 2.4-2

#### SECOND TUTORIAL DISPLAY

Sections 2.5 through 2.9 of the present document use a specific example to show how AI/ENCOA evaluates how much support exists for each of the COAs listed above. Then Section 2.10 analyzes alternative enemy AOAs.

The AI/ENCOA analysis is organized on the basis of five factor categories: 1) Terrain factors, 2) friendly force factors, 3) opposing force factors, 4) weather factors, and 5) risk factors.

Each of these five factors is divided further into subfactors. For example, terrain factors has six subfactors: 1) Fields of fire, 2) cover and concealment, 3) mobility, 4) key friendly terrain, 5) observation, and 6) natural/artificial obstacles.

The OPFOR doctrine models the Soviet doctrinal concepts evolved for conducting combat operations in a temperate climate, industrialized area. The applications window considered included France and the Low Countries and extended eastward into the Western Departments of the USSR. It is probably equally applicable to many portions of North America.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

-Main Menu-	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

#### EXHIBIT 2.4-3

##### THIRD TUTORIAL DISPLAY

The five factor categories listed above - TERRAIN FACTORS, FRIENDLY FORCE FACTORS, etc., are themselves said to be "subfactors" of the single "Top-level Factor", the OPFOR COA, or Opposing Force Course of Action.

The purpose of AI/ENCOA is to evaluate how much support exists for each of the four COAs - Primary Attack, Secondary Attack, etc. - from the information available about any given factor. Of course, the information available about a given factor includes all the information available about its subfactors, its sub-subfactors, etc.



The questions that AI/ENCOA asks you are directly tied to the five factor categories in AI/ENCOA. When you answer a question in AI/ENCOA, a score is given to each COA to indicate how much that factor supports each COA. For example, if you said that the "Fields of Fire" are greater than 3000 meters, then the "Defend" COA would get a higher score than the "Primary Attack" COA because, on the basis of "Fields of Fire" alone, the enemy would be more likely to defend than attack. (Note: Scores for a COA can range from 0 to 100. A 0 means that there is "no support for a COA"; a 100 means "very strong support for a COA".)

AI/ENCOA uses only the most key elements of information available to the decision staff for planning. For lower or higher echelons a different set of factors would be considered at different levels of resolution.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

```
|-----|-----|
|               |               |
|               |               |
|               |               |
|-----|-----|
| -Main Menu-   |               |
| <Esc> Quit AI/ENCOA 1. Present Tutorial |               |
| <?> HELP      2. Courses of Action   |               |
| <PrtSc> Print Screen 3. Avenues of Approach |               |
|-----|-----|
```

#### EXHIBIT 2.4-4

#### FOURTH TUTORIAL DISPLAY

Some factors are more important than other factors in predicting the enemy's COA. Therefore, after you answer the questions, AI/ENCOA multiplies the scores by "relative weights" in order to calculate an overall score, between 0 and 100, for each enemy COA. The higher the overall score for a COA, the stronger the support for it. If the COA with the highest overall score is 10 points higher than the COA with the second highest overall score, then the information strongly supports that COA over the other COAs. COAs with overall scores greater than 80 have very strong support.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

-Main Menu-	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

#### EXHIBIT 2.4-5

#### FIFTH TUTORIAL DISPLAY

AI/ENCOA automatically does all the scoring and weighting for you and produces the final scores for you to inspect and analyze in various ways. AI/ENCOA can do this automatically because it is an artificial intelligence system. We've given it AI by building in the rules and numerical assessments of an expert in the domain of Army tactical intelligence analysis. (Note: Appropriate technical personnel can learn how to go into AI/ENCOA and make changes to its expert rule base by consulting the AI/ENCOA Final Report. Indeed, since AI/ENCOA is a prototype, enhancements to its expert knowledge base probably will be made in the future.)

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

```
|-----|
|               |
|               |
|-----|
| -Main Menu-   |
| <Esc> Quit AI/ENCOA 1. Present Tutorial |
| <?> HELP      2. Courses of Action   |
| <PrtSc> Print Screen 3. Avenues of Approach |
|-----|
```

#### EXHIBIT 2.4-6

##### SIXTH TUTORIAL DISPLAY

The full reference to the Final Report referred to above is,  
"Combining Decision Analysis and Artificial Intelligence Techniques:  
An Intelligent Aid for Estimating Enemy Courses of Action."

You are now ready to use AI/ENCOA. In doing so, please remember the following three points:

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

-Main Menu-	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

EXHIBIT 2.4-7

SEVENTH TUTORIAL DISPLAY

1) The bottom of the display always has four information windows.

- \* The red window near the middle of the display tells you the factor being analyzed.
- \* The green window, titled DESCRIPTION, gives information about this factor: the weight of the factor at its level in the hierarchy; the percentage of subfactors that have been given scores for this factor; the sector or avenue of approach being examined; the number of subfactors below the current factor; and the number of answered and unanswered questions.
- \* The green ECOA SCORES window displays the score on the COAs for the factor.
- \* The blue MENU window shows available selection options.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

```
-----|-----|
|                                             |
|                                             |
|-----|-----|
| -Main Menu-                               |
| <Esc> Quit AI/ENCOA 1. Present Tutorial   |
|   <?> HELP      2. Courses of Action    |
| <PrtSc> Print Screen 3. Avenues of Approach |
|-----|-----|
```

#### EXHIBIT 2.4-8

#### EIGHTH TUTORIAL DISPLAY

2) The menu at the bottom of the screen lists the choices you may make. You interact with AI/ENCOA by pressing the keys indicated in this menu. When you press a key, either a new menu will appear in the menu window, or new information will be displayed in this large blue area near the top of the screen.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

Main Menu	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

#### EXHIBIT 2.4-9

##### NINTH TUTORIAL DISPLAY

The blue MENU window may actually contain any of several different menus, depending on what analysis AI/ENCOA is currently performing. Here the Menu shown is "Main Menu". Other possible menus appearing in this location include: Solution Menu, Save/Restore Answer Set Menu, Question Menu, Score Summarization Menu, Analysis Menu, Discrimination Analysis Menu, and Sensitivity Analysis Menu. Each of these menus, and its uses, will be demonstrated later in the present document. See Section 3, "Compendium of Menu Options," for further discussion of this topic.

3) You can always get an explanation of the menu so that you know what to do. To get this explanation, press the question mark key (<?>) for HELP.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

-Main Menu-	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

EXHIBIT 2.4-10

TENTH TUTORAL DISPLAY

This brief tutorial in AI/ENCOA is now over. We recommend that you use the AI/ENCOA user's manual to work through the "demonstration analysis". To start the "demonstration analysis", follow the steps outlined in the user's manual.

<Ret> to continue    <Esc> to end    <PrtSc> to print screen

Main Menu	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<PrtSc> Print Screen	3. Avenues of Approach

#### EXHIBIT 2.4-11

#### ELEVENTH TUTORIAL DISPLAY

The next display, obtained by pressing <Ret>, will look like this display, except that the top of the display will be blank. To continue the demonstration, turn to Exhibit 2.5-1.



## 2.5 Restoring the COA Demonstration

To introduce new users to the capabilities of AI/ENCOA, a demonstration that involves evaluating possible enemy Courses of Action (COAs) has been saved in the AI/ENCOA system. This demonstration is based on the U.S. Army Intelligence Center and School problem described in Appendix A.

As discussed in the Tutorial, there are just four possible enemy COAs under consideration in this demonstration:

1. Primary Attack;
2. Secondary Attack;
3. Defense; and
4. Withdrawal.

The present demonstration involves a single, division-wide sector. In this demonstration, the answers to forty questions are used to determine how much support each of the factors (terrain factors, etc.) and subfactors give to each of the four COAs. To save time, answers to all but six of the questions have been saved as a part of the demonstration. To run the demonstration, the first step is to restore the previously saved answer set -- that is, to bring it back into the active part of AI/ENCOA. The exhibits in the present Subsection describe how to restore the COA demonstration.

For how many sectors is the analysis to be run? (1-8) 1

Name of Sector 1: sect 1

Main Menu	
<Esc> Quit AI/ENCOA	1. Present Tutorial
<?> HELP	2. Courses of Action
<FrtSc> Print Screen	3. Avenues of Approach

#### EXHIBIT 2.5-1

#### SELECTING NUMBER OF (DIVISION-WIDE) SECTORS, AND

#### SECTOR NAMES FOR COURSES OF ACTION

Start with AI/ENCOA in the state it was in at the end of the Tutorial session. (See Exhibit 2.4-11, "Eleventh Tutorial Display".) Press <Ret>, if you have not already done so, so that the top of the display is blank. Then, with the Main Menu still displayed, press <2> for "Courses of Action", since it is a COA demonstration that you are about to restore.

The resulting display states that there will be a delay while information is read in from disk, then prompts: "For how many sectors is the analysis to be run? (1-8)". Note that here "sectors" means division-wide sectors. Enter the number 1; you do not have to press the return key. Now you will receive the prompt, "Name of Sector 1:". Enter the answer, "sect 1", and press <Ret>. This results in Exhibit 2.5-2.

# OPFOR COA - Top-level Factor

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 0	#Ans Ques: 0	0	0	0	0
Sec:sect 1	#Unans Ques: 40				
Solution Menu-----					
(Esc) Quit Menu	1. Answer Questions	4. Modify Sectors			
(?) HELP	2. Display Results	5. Save/Restore Answers			
(PrtSc) Print Screen	3. Analyze Results				

## EXHIBIT 2.5-2

### SOLUTION MENU DISPLAY

This display is reached when the <Ret> is pressed, after entering "sect 1", as shown in the preceding Exhibit. The Description and ECOA Scores in the display have been filled for the first time. The division-wide sector name "sect 1" appears opposite Sec (for "Sector name"). Information showing that there are forty unanswered and zero answered questions appears at the appropriate locations; all questions are shown as unanswered because the prestored answers will not be read in until later. (See Exhibits 2.5-4 and 2.5-5.)

All ECOA scores are 0 because no questions have been answered, and "%Sol", the percentage of the underlying demonstration that has been "solved", is shown as 0 for the same reason. The "Wgt" or weight is 1.00 because, by definition, the weight of the Top-level factor is always 1. The "#Subfactors" or number of subfactors is 5 because in the present demonstration the Top-level factor, the OPFOR COA, is itself composed of five factors. (See Exhibits 2.4-3 and 2.6-1)

Press <5> ("Save/Restore Answers") to arrive at the Save/Restore Answer Set Menu shown in the next Exhibit.

See Exhibit 3-3 for a brief discussion of the other options shown in this menu.

OPFOR COA - Top-level Factor

Description-----		IECOA Scores-----			
Wgt: 1.00	NSubfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 0	WAns Ques: 0	0	0	0	0
Sec:sect 1	MUnans Ques: 40				
Save/Restore Answer Set Menu-----					
<Esc> Quit Menu		1. Save Current Answer Set			
<?> HELP		2. Restore Previously Saved Answer Set			
<PrtSc> Print Screen		3. Remove Previously Saved Answer Set			

EXHIBIT 2.5-3

SAVE/RESTORE ANSWER SET MENU DISPLAY

The Solution Menu has been replaced by the Save/Restore Answer Set Menu. Press <2> ("Restore Previously Saved Answer Set") to arrive at the display shown in the next Exhibit.

See Exhibit 3-12 for a brief discussion of the other options shown on this menu.

Select the answer set that you wish to restore  
1 coademo

Enter an answer set's number :

```

                                OPFOR COA - Top-level Factor
-----Description-----IECOA Scores-----
| Wgt: 1.00  #Subfactors: 5 | PRIMARY  SECONDARY  DEFEND  WITHDRAW |
| %Sol: 0    #Ans Ques: 0 | 0        0        0        0 |
| Sec:sect 1 #Unans Ques: 40 |
-----Save/Restore Answer Set Menu-----
| <Esc> Quit Menu 1. Save Current Answer Set |
| <?> HELP      2. Restore Previously Saved Answer Set |
| <PrtSc> Print Screen 3. Remove Previously Saved Answer Set |
-----
```

#### EXHIBIT 2.5-4

##### ANSWER SET SELECTION

Press <1> to select the answer set prestored for the COA demonstration. Then type <Ret> to arrive at the display shown in the next Exhibit.

Select the answer set that you wish to restore  
1 coademo

Enter an answer set's number : 1  
Wait 30-45 seconds for answer set to be restored.  
Saved answer set has been restored.

#### OPFOR COA - Top-level Factor

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 81	#Ans Ques: 34	44	42	35	7
Sec:sect 1	#Unans Ques: 6				
Save/Restore Answer Set Menu-----					
(Esc) Quit Menu	1. Save Current Answer Set				
(?) HELP	2. Restore Previously Saved Answer Set				
(PrtSc) Print Screen	3. Remove Previously Saved Answer Set				

#### EXHIBIT 2.5-5

##### INTERMEDIATE DISPLAY

The prestored COA answer set has been restored.

Press <Esc> to return to the Solution Menu (Exhibit 2.5-6). Note that the numbers of answered and unanswered questions have been changed to reflect the content of the previously saved answer set. Likewise, the ECOA Scores and the "percent solved" have changed.

The ECOA Scores have become nonzero because, with some of the questions answered, there is now a basis for evaluating some of the COAs. "%Sol" gives an indication of how much information AI/ENCOA has on which to base its evaluation; this percentage figure includes not only how many questions are answered, but also the relative weights of the factors affected by those questions.

After the COA demonstration has been restored, Section 2.6 will show how to use the AI/ENCOA displays to investigate the names of and interrelationships among the various factors and subfactors in the demonstration. Then Section 2.7 will show how to answer the remaining questions, Section 2.8 will show how to display the results, and Section 2.9 will show how to subject the results to various discrimination and sensitivity analyses. Finally, in Section 2.10 a related demonstration will show how to use AI/ENCOA to evaluate alternative Avenues of Approach (AOAs).

## 2.6 Examining the Network Structure

Displays of the factors used in predicting the enemy's COA are easy to obtain; just follow the instructions given in Exhibit 2.6-1. Then try moving through the network structure (the "hierarchy") of factors by using the arrow keys on the numeric keypad. Exhibits 2.6-2 and 2.6-3 illustrate the methodology, and provide information about the relative weights associated with the factors.



```

|-----|
| TERRAIN FACTORS
|
| FRIENDLY FORCE FACTORS
|
OPFOR COA-----| OPFOR FORCE FACTORS
|
| WEATHER FACTORS
|
| RISK FACTORS

```

#### OPFOR COA - Top-level Factor

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 81	#Ans Ques: 34	44	42	35	7
Sec:sect 1	#Unans Ques: 6				
Save/Restore Answer Set Menu-----					
(Esc) Quit Menu	1. Save Current Answer Set				
(?) HELP	2. Restore Previously Saved Answer Set				
(PrtSc) Print Screen	3. Remove Previously Saved Answer Set				

#### EXHIBIT 2.6-1

#### NETWORK STRUCTURE DIAGRAM FOR OPFOR COA

Obtain this display from the display shown in Exhibit 2.5-5 by pressing <←> on the numeric keypad.

"OPFOR COA" appears in yellow letters and is identified in the display as being the Top-level Factor. Further confirmation is obtained by observing that OPFOR COA is itself not a subfactor of any other factor.

OPFOR COA is divided into five factors: TERRAIN FACTORS, FRIENDLY FORCE FACTORS, OPFOR FORCE FACTORS, WEATHER FACTORS, and RISK FACTORS. The number (5) of factors is summarized in the "Description" table contained within the display; it is labeled "Subfactors" in that display, since the five factors are in fact subfactors of the selected Top-level Factor, OPFOR COA.

The "weight" of the OPFOR COA factors is 1.00, as is also shown in the Description. By definition, the weight of the Top-level Factor is always 1.

```

      | -TERRAIN FACTORS
      |
      | -FRIENDLY FORCE FACTORS--|
      |
      | -OPFOR FORCE FACTORS
      |
      | -WEATHER FACTORS
      |
      | -RISK FACTORS

      | -LT OR HEAVY DIVISION*
      |
      | -FRNDLY DIVSN STRENGTH*
      |
      | -SIZE OF CORPS RESERVES*
      |
      | -FRNDLY LOGISTIC SUPPRT*
      |
      | -MOST LIKELY FRNDLY COA*
      |
      | -FRIENDLY C AND C*

```

```

      FRIENDLY FORCE FACTORS - Subfactor of OPFOR COA
-----
| -Description-----| IECOM Scores-----
| Wgt: 0.20   #Subfactors: 6 | PRIMARY   SECONDARY   DEFEND   WITHDRAWN
| %Sol: 100   #Ans Ques: 6 |    46      70        78       13
| Sec:sect 1  #Unans Ques: 0 |
| -Save/Restore Answer Set Menu-----
| (Esc) Quit Menu      1. Save Current Answer Set
| (?) HELP              2. Restore Previously Saved Answer Set
| (PrtSc) Print Screen 3. Remove Previously Saved Answer Set
-----

```

## EXHIBIT 2.6-2

### NETWORK STRUCTURE DIAGRAM FOR FRIENDLY FORCE FACTORS

Starting from the display shown in Exhibit 2.6-1, obtain the display above by first pressing the < → > key (yielding a display highlighting TERRAIN FACTORS), then pressing the < ↓ > key. Note that "FRIENDLY FORCE FACTORS" is highlighted. Its six (see Description window in display) subfactors are shown. The asterisks to the right of the subfactor names in the display indicate that none of these subfactors has any further (sub-) subfactors.

The weight of the FRIENDLY FORCE FACTORS is shown in the Description display window to the .20. The weights of the other factors of OPFOR COA could be obtained similarly. Summarizing,

<u>FACTOR</u>	<u>WEIGHT</u>
FRIENDLY FORCE FACTORS	0.20
TERRAIN FACTORS	0.15
OPFOR FORCE FACTORS	0.50
WEATHER FACTORS	0.10
RISK FACTORS	0.05

The sum of the weights of these five factors is therefore 1.00. This illustrates the general rule that the sum of the weights of all factors that are subfactors of the same factor must be 1. In the present case, the factors are all subfactors of the Top-level Factor, OPFOR COA.

```

|CURRENT DISPOSITION-----| |REGIMENTS
|
|OPFOR STRNGTH AND COND* | |BRIDGE MATERIAL*
|
|TANKS IN 2ND ECHELON* | |ANTI TANK UNIT PLACENT*
|
OPFOR FORCE FACTORS-----| |
|LOGISTIC SUPPORT OPFOR | |ARTILLERY
|
|OPFOR C AND C | |NUMBER OF SAM BTRIS*
|
|LOCAL AIR SUPERIORITY* | |OP MANEUVR GRF PRESENT*

```

#### CURRENT DISPOSITION - Subfactor of OPFOR FORCE FACTORS

```

|Description-----|ECOA Scores-----|
| Wgt: 0.48   #Subfactors: 6 | PRIMARY   SECONDARY   DEFEND   WITHDRAWN
| %Sol: 88     #Ans Ques: 10 | 85        8          0        1
| Sec:sect 1   #Unans Ques: 3 |
|Save/Restore Answer Set Menu-----|
| <Esc> Quit Menu      1. Save Current Answer Set
| <?> HELP            2. Restore Previously Saved Answer Set
| <PrtSc> Print Screen 3. Remove Previously Saved Answer Set
|-----|

```

#### EXHIBIT 2.6-3

#### NETWORK STRUCTURE DIAGRAM FOR CURRENT DISPOSITION

Starting from the display shown in Exhibit 2.6-2, obtain the above display by pressing < | > and then < — >. Note that CURRENT DISPOSITION is highlighted.

## 2.7 Answering Questions

AI/ENCOA bases its evaluation of enemy COAs on the answers to certain questions. In the current demonstration, some questions remain unanswered, although most of the questions were answered prior to beginning the demonstration and were restored earlier in the demonstration (See Exhibits 2.5.4 - 2.5.5.)

The present Subsection demonstrates how to answer questions within AI/ENCOA. Two HELP displays are relevant here; they are shown in Exhibits 2.7.1 and 2.7.2, and may be obtained as described in the captions to these exhibits.

As shown in the "Description" parts of these displays, 34 questions were answered prior to the beginning of the demonstration, and 6 questions remain to be answered. How to answer the questions is discussed in Exhibits 2.7.3 and 2.7.4.

**\*\* AI/ENCOA Solution Menu Explanation \*\***

1. Answer Questions ----- Answer the questions for this factor. You can also modify individual answers or erase all answers.
2. Display Results ----- Display results of factor's scores for the ECOAs.
3. Analyze Results ----- Permit discrimination or sensitivity analysis.  
 (Discrimination: which factors support the different ECOAs?)  
 (Sensitivity: how sensitive are the results to changes in the answers to certain questions or to the relative weights placed on the factors?)
4. Modify Sectors or AOA - Add or rename Sectors or AOAs.
5. Save/Restore Answers -- Save this ECOAs answers, or restore a previous one.  
 (Esc) -- Return to the main menu.  
 (?) -- Display this textual menu description.  
 (PrtSc) -- Copy the screen on the printer.  
 (PgUp), (PgDn) -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

OPFOR COA - Top-level Factor

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 81	#Ans Ques: 34	44	42	35	7
Sec:sect 1	#Unans Ques: 0				

-----

Solution Menu-----		
(Esc) Quit Menu	1. Answer Questions	4. Modify Sectors
(?) HELP	2. Display Results	5. Save/Restore Answers
(PrtSc) Print Screen	3. Analyze Results	

-----

**EXHIBIT 2.7-1**

**DISPLAY OF AI/ENCOA SOLUTION MENU EXPLANATION**

To obtain this display from the display shown in Exhibit 2.6-3, press < — > twice to return to the Top-level Factor. Then press <Esc> to obtain the Solution Menu. Finally, press <?>.

**\*\* Question Menu Explanation \*\***

1. Answer All Questions-- Answer questions pertaining to the current factor. Questions can be skipped by simply hitting <return>.
  2. Unanswered Questions-- Answer questions not already answered, if any, which pertain to the current factor.
  3. Modify Answers ----- One by one, inspect and possibly change answers to pertinent questions.
  4. Display Answers ----- Show each attribute relevant to the current factor and its status.
  5. Reset Answers ----- Erase pertinent question answers, effectively resetting the portion of the hierarchy dependent on them.
- <Esc> -- Return to the solution menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select sector or AQA.

OPFOR COA - Top-level Factor

```

-----
I-Description-----
I Wgt: 1.00   #Subfactors: 5 | PRIMARY   SECONDARY   DEFEND   WITHDRAW
I %Sol: 81    #Ans Ques: 34 | 44        42        35        7
I Sec:sect 1  #Unans Ques: 6 |
-----
I-Question Menu:-----
I  <Esc> Quit Menu    1. Answer All Questions    4. Display Answers
I  <?> HELP          2. Unanswered Questions    5. Erase Answers
I  <PrtSc> Print Screen 3. Modify Answers
-----

```

**EXHIBIT 2.7-2**

**DISPLAY OF QUESTION MENU EXPLANATION**

Starting from the display in Exhibit 2.7-1, obtain the present display by pressing first <1> ("Answer Questions"), then <?>.

Characterize OPFOR Bridging Material Placement as:

- 1 : Bridging Employed Forward Plus Lots of Additional Units
- 2 : Distributed in Sector at Critical Nodes
- 3 : Bridging Forward Employed
- 4 : Bridging Well Rearward
- 5 : No Bridging in Sector

1

Characterize OPFOR Anti-Tank Unit Placement as:

- 1 : Units Moving Forward
- 2 : Employed Flank Forward
- 3 : Grouped in 3-30 km. Kill Zones
- 4 : Uniformly Distributed
- 5 : Moving Rearward

1

OPFOR COA - Top-level Factor

Description		IECOA Scores				
Wgt: 1.00	#Subfactors: 5	1	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 81	#Ans Ques: 34	1	44	42	35	7
Sec:sect 1	#Unans Ques: 6	1				

Question Menu:

<Esc> Quit Menu	1. Answer All Questions	4. Display Answers
<F> HELP	2. Unanswered Questions	5. Erase Answers
<PrtSc> Print Screen	3. Modify Answers	

EXHIBIT 2.7-3

ANSWERING REMAINING UNANSWERED QUESTIONS

Starting from the display in Exhibit 2.7-2, press <2> ("Unanswered Questions") to obtain the start of the present display. At that point only the first question is displayed; the cursor blinks over the position now occupied by the first "1" in the leftmost column.

Assuming the desired response to the first displayed question is "Bridging Employed Forward Plus Lots of Additional Units", press <1> <Ret>, (as indicated above). The second question and its answer are indicated similarly

-----  
Enter Number of OPFOR Artillery Battalions within 30 - 50 kms ( 0 - 3 ) : 3  
-----

Characterize OPFOR Service Unit Movement as:

- 1 : Moving Forward
- 2 : Not Moving
- 3 : Moving Rearward

1

-----  
True or False -- OPFOR Army Operations Post is in Sector

Enter 't' for true, 'f' for false: t

True

-----  
True or False -- OPFOR has Localized Air Superiority

Enter 't' for true, 'f' for false: t

OPFOR COA - Top-level Factor

Description		IECOA Scores				
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
%Sol: 81	#Ans Ques: 34	44	42	35	7	
Sec:sect 1	#Unans Ques: 6					

-----  
Question Menu:  
-----  
(Esc) Quit Menu      1. Answer All Questions      4. Display Answers  
(?) HELP              2. Unanswered Questions      5. Erase Answers  
(PrtSc) Print Screen      3. Modify Answers  
-----

#### EXHIBIT 2.7-4

#### CONTINUATION

The display here is a continuation of the display shown in Exhibit 2.7-3. It simply shows the user's answers to the next four questions.

"Scrolling" is automatic within the region where questions are displayed. The user need only answer the questions as they are presented to him. If the user wishes to skip over a question, or if no information is available to answer it, he may so indicate by typing <Ret> instead of an answer.



After the last question has been answered and <Ret> pressed, the "Description" portion of the display is updated. In the present example the result will be to show the number of answered questions("#Ans Ques") equal to 40 and the number of questions unanswered("#Unans Ques") equal to 0. These figures do not show up in Exhibit 2.7-4 because the final <Ret> had not yet been typed at the time the screen was printed out. These figures first appear in Exhibit 2.8-1

## 2.8 Results of the COA Demonstration

After all the questions have been answered (Exhibit 2.7-4), press <Esc> to return from the Question Menu to the Solution Menu, press <2> ("Display Results") to obtain the Score Summarization Menu, and then press <7> to obtain the Score Summarization Menu Explanation shown in Exhibit 2.8-1.

This explanation lists four types of results summaries that are available. The present COA demonstration will show examples of the first three types of summaries: Textual Summary (Exhibits 2.8-2 through 2.8-5), Tabular Summary (Exhibit 2.8-6), and Numerical Summary (Exhibit 2.8-7). The Cross Region Summary is not appropriate to illustrate at present, because there is only one "region" defined -- namely, the division-wide sector we have labeled "sect 1". Later on, when we have finished the COA analysis and are studying possible AOAs (Avenues of Approach), there will be two "regions" -- two possible AOAs -- under consideration. A "Cross Region" or "Cross AOA" Summary will be exhibited at that time.

**\*\* Score Summarization Menu Explanation \*\***

1. Textual Summary ----- Brief English description of results.
2. Tabular Summary ----- Display for the current factor and its subfactors:  
the degree solved, factor weight, and an indication  
of the options with strong support.
3. Numerical Summary ---- Display for the current factor and its subfactors:  
the degree solved, factor weight, and option scores.
4. Cross Region Summary - Summary of scores for the current factor across  
defined regions.

    <Esc> -- Return to the solution menu.

    <?> -- Display this textual menu description.

    <PrtSc> -- Copy the screen on the printer.

    <PgUp>, <PgDn> -- Select sector or AOA.

    Arrow keys move through factor hierarchy.

OPFOR COA - Top-level Factor

```

|-----|-----|-----|-----|-----|
|Description-----|ECOA Scores-----|
| Wgt: 1.00  #Subfactors: 5 | PRIMARY  SECONDARY  DEFEND  WITHDRAW
| %Solved: 100  #Ans Ques: 40 | 76      61      43      9
| Sec:sect 1  #Unans Ques: 0 |
|-----|-----|-----|-----|
|Score Summarization Menu-----|
| <Esc> Quit Menu    1. Textual Summary          4. Cross Sector Summary
| <?> HELP          2. Tabular Summary
| <PrtSc> Print Screen 3. Numerical Summary
|-----|-----|-----|-----|

```

**EXHIBIT 2.8-1**

**SCORE SUMMARIZATION MENU EXPLANATION**

After answering the remaining questions (Section 2.7.4), obtain this display by pressing <Esc>, then <2> ("Display Results"), and finally, <?>.

A Textual Display (Exhibit 2.8-2) for the current factors is obtained by pressing <1> ("Textual Summary"). In the present demonstration, this Textual Display is too big to fit on a single screen. Therefore it is continued over several screens (Exhibits 2.8-3 through 2.8-5). Successive continuations are obtained by pressing <Ret>.

The Textual Display begins by exhibiting the best COA or COAs. The best COA is shown as the one with the highest score. Any other COAs whose scores were within one point of the highest score would also have been listed as being among the best.

An ECOA is said to have "very strong", "strong", ..., or "no" support depending on its score, as explained in the rules below.

If the score is less than 1, then the ECOA is said to have "no" support.

If the score is at least 1 but less than 21, then the ECOA is said to have "very weak" support.

If the score is at least 21 but less than 41, then the ECOA is said to have "weak" support.

If the score is at least 41 but less than 61, then the ECOA is said to have "moderate" support.

If the score is at least 61 but less than 81, then the ECOA is said to have "strong" support.

If the score is at least 81, then the ECOA is said to have "very strong" support.

By definition, a subfactor provides "strong relative support" for an ECOA if its score for that ECOA is within ten points of the top score for any ECOA for that factor. Likewise by definition, a

subfactor is considered to "provide support" for other ECOAs if it does not provide strong relative support for the given ECOA.

Given 100% of OPFOR COA factors are solved, best ECOA is PRIMARY ATTACK.

For this factor, PRIMARY ATTACK has strong support with a score of 76.4.

The subfactors that provide strong relative support for PRIMARY ATTACK over other ECOAs are TERRAIN FACTORS and  
OPFOR FORCE FACTORS.

The subfactors that provide support for other ECOAs over PRIMARY ATTACK are FRIENDLY FORCE FACTORS,  
WEATHER FACTORS and  
RISK FACTORS.

<More>

OPFOR COA - Top-level Factor					
Description		IECOA Scores			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Solved: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0				
Score Summarization Menu					
<Esc> Quit Menu		1. Textual Summary		4. Cross Sector Summary	
<F> HELP		2. Tabular Summary			
<PrtSc> Print Screen		3. Numerical Summary			

## EXHIBIT 2.8-2

### SUMMARY OF SCORES: TEXTUAL DISPLAY FOR PRIMARY ATTACK

Obtain this display from the display of Exhibit 2.8-1 by pressing <1>. This display is continued over several screens (Exhibits 2.8-3 through 2.8.5). Press <Ret> to obtain successive continuations.

The display shows the best ECOA or ECOAs, the degree of support for each ECOA, the subfactors providing strong relative support for each ECOA over other ECOAs, and for each ECOA the subfactors providing support for other ECOAs. The numerical meanings assigned to "best" ECOAs, "strong" relative support, etc., are given in the accompanying text.

Given 100% of OPFOR COA factors are solved, best ECOA is PRIMARY ATTACK.

For this factor, SECONDARY ATTACK has strong support with a score of 61.1.

The subfactors that provide strong relative support for SECONDARY ATTACK over other ECOAs are TERRAIN FACTORS,  
FRIENDLY FORCE FACTORS,  
WEATHER FACTORS and  
RISK FACTORS.

The subfactor that provides support for other ECOAs over SECONDARY ATTACK is OPFOR FORCE FACTORS.

<More>

OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0				
Score Summarization Menu					
<Esc> Quit Menu		1. Textual Summary		4. Cross Sector Summary	
<?> HELP		2. Tabular Summary			
<PrtSc> Print Screen		3. Numerical Summary			

EXHIBIT 2.8-3

SUMMARY OF SCORES: TEXTUAL DISPLAY FOR SECONDARY ATTACK

Given 100% of OPFOR COA factors are solved, best ECOA is PRIMARY ATTACK.

For this factor, DEFEND has moderate support with a score of 42.8.

The subfactors that provide strong relative support for DEFEND over other ECOAs are FRIENDLY FORCE FACTORS and RISK FACTORS.

The subfactors that provide support for other ECOAs over DEFEND are TERRAIN FACTORS, OPFOR FORCE FACTORS and WEATHER FACTORS.

<More>

#### OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0				
Score Summarization Menu					
<Esc> Quit Menu	1. Textual Summary	4. Cross Sector Summary			
<?> HELP	2. Tabular Summary				
<PrtSc> Print Screen	3. Numerical Summary				

#### EXHIBIT 2.8-4

#### SUMMARY OF SCORES: TEXTUAL DISPLAY FOR DEFEND



Given 100% of OPFOR COA factors are solved, best ECOA is PRIMARY ATTACK.

For this factor, WITHDRAW has very weak support  
with a score of 8.8.

The subfactors that provide support for other ECOAs over WITHDRAW  
are TERRAIN FACTORS,  
FRIENDLY FORCE FACTORS,  
OPFOR FORCE FACTORS,  
WEATHER FACTORS and  
RISK FACTORS.

```

                                OPFOR COA - Top-level Factor
-----
|Description-----|ECOA Scores-----|
| Wgt: 1.00  #Subfactors: 5 | PRIMARY  SECONDARY  DEFEND  WITHDRAW |
| %Sol: 100   #Ans Ques: 40 |    76    61      43    9 |
| Sec:sect 1  #Unans Ques: 0 | | | | |
|-----|
|Score Summarization Menu-----|
| <Esc> Quit Menu    1. Textual Summary          4. Cross Sector Summary |
|  <?> HELP        2. Tabular Summary          |
| <PrtSc> Print Screen 3. Numerical Summary    |
|-----|

```

#### EXHIBIT 2.8-5

#### SUMMARY OF SCORES: TEXTUAL DISPLAY FOR WITHDRAW

A Tabular Summary for the current factor is shown and discussed in Exhibit 2.8-6. The asterisks in this exhibit enable the user to see at a glance which ECOAs are strongly supported relative to the others. Such strong relative support is shown for the subfactors of the current factor as well as for the current factor.

Factor Name	Degree Rel.		ECOA Scores			
	Solved	Weight	PRIMARY	SECONDARY	DEFEND	WITHDRAW
----- ----- ----- ----- ----- ----- -----						
Current Factor:						
OPFOR COA	100%	1.00	*			
Subfactors:						
TERRAIN FACTORS	100%	0.15	*	*		
FRIENDLY FORCE FACTORS	100%	0.20		*	*	
OPFOR FORCE FACTORS	100%	0.50	*			
WEATHER FACTORS	100%	0.10		*		
RISK FACTORS	100%	0.05		*	*	

\* indicates strong support for an ECOA relative to the others.

OPFOR COA - Top-level Factor						
Description-----		ECOA Scores-----				
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
%Sol: 100	#Ans Ques: 40	76	61	43	9	
Sec:sect 1	#Unans Ques: 0					
-----						
Score Summarization Menu-----						
(Esc) Quit Menu	1. Textual Summary	4. Cross Sector Summary				
(?) HELP	2. Tabular Summary					
(PrtSc) Print Screen	3. Numerical Summary					
-----						

#### EXHIBIT 2.8-6

##### SUMMARY OF SCORES: TABULAR SUMMARY

Obtain this display from the display of Exhibit 2.8-5 by pressing <2> ("Tabular Summary"). Since all the questions have been answered, the demonstration is 100% solved both for its Top-level Factor (OPFOR COA and all its subfactors. Hence the "Degree Solved" column will show 100% throughout the rest of present demonstration. The "Degree Solved" for the "Current Factor" is by definition the same as the "%Sol" shown in the "Description" part of the display.

Earlier, while some questions were still unanswered, the "%Sol" was less than 100%. See Exhibit 2.5-5, for example, where the "%Sol" was 81.

The \*'s under "ECOA Scores" indicate which COAs are strongly supported relative to the others, based on the factor or subfactor leading the row where the \* occurs. By definition, a COA is "strongly supported" based on a given factor or subfactor if and only if its score is within ten points of the top-ranking score based on that factor or subfactor.

The interpretation of the scores for the current factor and its subfactors is discussed in more detail in the Textual Displays (Exhibits 2.8.2 through 2.8.5). The scores themselves are given in the Numerical Display (Exhibit 2.8-7).

The information in the foregoing displays (Exhibits 2.8-2 through 2.8-6) is actually all derived (to within roundoff error) from the information in the single Numerical Display (Exhibit 2.8-7). Looking at the ECOA Scores for OPFOR COA, clearly the Primary Attack ECOA is the "best" ECOA, with a score of 76, indicating "strong" support (Exhibits 2.8-2 through 2.8-5). Since no other ECOA score for OPFOR COA is less than one point away from the top score (76), there are no ties for "best".

A word is in order about the mathematical procedure used to calculate the ECOA scores. The same basic procedure holds for any factor, including the Top-level Factor:

For a given COA option: The score for a Bottom-level Factor is determined by the answer to the question associated with the Bottom-level Factor, see Appendix B. For any other factor, the score is given by the sum of the weighted scores of its subfactors; the weight to use with each subfactor is just the Relative Weight of that subfactor. By applying this procedure the score may be computed first for all Bottom-level Factors, then for all factors whose subfactors consist entirely of Bottom-level Factors, etc., until finally the scores for all factors, including the Toplevel Factor, are obtained.

Factor Name	Degree of Rel.		ECOA Scores			
	Solved	Weight	PRIMARY	SECONDARY	DEFEND	WITHDRAW
----- ----- ----- ----- ----- ----- -----						
Current Factor:						
OPFOR COA	100%	1.00	76	61	43	9
Subfactors:						
TERRAIN FACTORS	100%	0.15	77	86	63	23
FRIENDLY FORCE FACTORS	100%	0.20	46	70	78	13
OPFOR FORCE FACTORS	100%	0.50	98	49	21	5
WEATHER FACTORS	100%	0.10	55	70	50	0
RISK FACTORS	100%	0.05	24	55	45	10

#### OPFOR COA - Top-level Factor

Description		ECOA Scores				
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
D.Sol: 100	#Ans Ques: 40	76	61	43	9	
Sec:sect 1	#Unans Ques: 0					
Score Summarization Menu						
<Esc> Quit Menu	1. Textual Summary			4. Cross Sector Summary		
<?> HELP	2. Tabular Summary					
<PrtSc> Print Screen	3. Numerical Summary					
-----						

#### EXHIBIT 2.8-7

#### SUMMARY OF SCORES: NUMERICAL DISPLAY

Obtain this display from the display in Exhibit 2.8-6 by pressing <3> ("Numerical Summary").

The information in the displays shown in Exhibits 2.8-2 through 2.8-6 can all be derived from the information shown in the present display. In particular, the asterisks in Exhibit 2.8-6 occur wherever an ECOA score in the display above is written 10 points of the maximum ECOA score within its row. Within the column headed "SECONDARY," for instance, such asterisks appear in the rows headed "TERRAIN FACTORS", "FRIENDLY FORCE FACTORS", "WEATHER FACTORS", AND "RISK FACTORS". But the latter subfactors as just the ones "that provide strong relative support for SECONDARY ATTACK over other ECOAs" (Exhibit 2.8-3); the remaining (not asterisked) subfactor, OPFOR FORCE FACTORS "provides support for other ECOAs over SECONDARY ATTACK" (Exhibit 2.8-3). Similar remarks apply to the other options.

## 2.9 Analysis of the Demonstration Results

The meaningfulness of the results presented in Section 2.8 can be studied with the help of additional analyses built into AI/ENCOA. These analyses permit the user to perform Discrimination Analyses and Sensitivity Analyses. The use of these analyses is illustrated in the present subsection.

Exhibit 2.9-1 indicates very briefly the nature of these two types of analyses. Discrimination analysis lets you see how much each Bottom-level Factor contributes to the overall score for an ECOA, or to the difference between the overall scores for two ECOAs. In that sense it lets you "discriminate" between the Bottom-level Factors, determining which (according to the rules built into the AI/ENCOA) are important and which are less important for the ECOAs in question. Sensitivity analysis, in turn, lets you see how "sensitive" the results are to changes you might make to some of things that affect the AI/ENCOA scores.

**\*\* Analysis Menu Explanation \*\***

1. Discrimination Analysis - Generate displays indicating key elements of a factor's score for a given option, or the key differences between two option scores.
2. Sensitivity Analysis ---- Perform analyses of the current factor's score by examining its sensitivity to the weights of descendant factors and to the answers of relevant questions.

<Esc> -- Return to the solution menu.

<?> -- Display this textual menu description.

<PrtSc> -- Copy the screen on the printer.

<PgUp>, <PgDn> -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0				
-----					
Analysis Menu-----					
<Esc> Quit Menu    1. Discrimination Analysis					
<?> HELP        2. Sensitivity Analysis					
<PrtScr> Print Screen					
-----					

**EXHIBIT 2.9-1**

**DISPLAY OF ANALYSIS MENU EXPLANATION**

Obtain this display from the display shown in Exhibit 2.8-7 by typing first <Esc>, then <3> ("Analyze Results"), and finally <?>.

Here we will begin by exploring the use of AI/ENCOA to do Discrimination Analysis. We will then turn to Sensitivity Analysis.



Exhibit 2.9-2 shows the two types of Discrimination Analysis that AI/ENCOA offers. Consider first the Weighted Ranking . Since Primary Attack was the most strongly supported ECOA, Weighted Ranking of the Bottom-level Factors may be obtained corresponding to the Primary Attack ECOA. The necessary interaction is depicted in Exhibit 2.9-3.

**\*\* Discrimination Analysis Menu Explanation \*\***

1. Weighted Ranking --- For one ECOA, rank orders the bottom-level factors in the hierarchy according to their weighted scores (that is, wts x scores) so that you can see how much each bottom-level factor supports the ECOA.
  2. Difference Rankings --- For two ECOAs, rank orders the bottom-level factors in the hierarchy by their difference in weighted scores so you can see how much each bottom-level factor supports each of the two ECOAs. Positive values indicate that the first ECOA has a higher weighted score; Negative values indicate that the second has the higher weighted score.
- <Esc> -- Return to the analysis menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select sector or AOA.  
 Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

I-Description-----		IECOA Scores-----			
I Wgt: 1.00	#Subfactors: 5	I PRIMARY	SECONDARY	DEFEND	WITHDRAW
I %Sol: 100	#Ans Ques: 40	I 76	61	43	9
I Sec:sect 1	#Unans Ques: 0				
I-Discrimination Analysis Menu-----					
I <Esc> Quit Menu	1. Weighted Ranking for One ECOA				
I <?> HELP	2. Difference in Weighted Rankings for Two ECOAs				
I <PrtSc> Print Screen					

**EXHIBIT 2.9-2**

**DISPLAY OF DISCRIMINATION ANALYSIS MENU EXPLANATION**

Obtain this display from the previous one by pressing first <1> ("Discrimination Analysis"), then <?>.

```

|-----|
|          ECOAs Available for Discrimination Analysis:          |
|          1. PRIMARY ATTACK                                     |
|          2. SECONDARY ATTACK                                   |
|          3. DEFEND                                             |
|          4. WITHDRAW                                           |
|          Select a ECOA for analysis:                          |
|-----|

```

```

OPFOR COA - Top-level Factor
|-----|
| Description-----| ECOA Scores-----|
| Wgt: 1.00  #Subfactors: 5 | PRIMARY  SECONDARY  DEFEND  WITHDRAW |
| %Sol: 100   #Ans Ques: 40 |    76      61      43      9   |
| Sec:sect 1  #Unans Ques: 0 |-----|
| Discrimination Analysis Menu-----|
| <Esc> Quit Menu    1. Weighted Ranking for One ECOA          |
| <?> HELP          2. Difference in Weighted Rankings for Two ECOAs |
| <PrtSc> Print Screen-----|

```

### EXHIBIT 2.9-3

#### MENU FOR WEIGHTED RANKING

Obtain this display from the previous one by pressing <1> ("Weighted Ranking for One ECOA"). Then press <1> ("Primary Attack") to obtain the next display.

The result is shown in Exhibit 2.9-4. All the Bottom-level Factors contributing to the ECOA Score of 76 for Primary Attack are listed in the leftmost column. The "Overall Weight" of each Bottom-level Factor is shown next: this is defined as the weight of the Bottom-level Factor times the weight of each factor of which the Bottom-level Factor is a subfactor, or a sub-subfactor. Mathematically, it can be shown that the Overall Weights of all the Bottom-level Factors sum to 1, and so each individual Overall Weight represents the proportion of the ECOA Score that is attributable to the Bottom-level Factor associated with that Overall Weight.

Next to the Overall Weights, in the column headed PRIMARY, is the unweighted score assigned to each Bottom-level Factor as a result of the answer to the question associated with that Bottom-level Factor. The unweighted score times the Overall Weight gives the Weighted Score, shown in the next column. The Weighted Scores form a nonincreasing sequence from top to bottom of the display; it was this sequence that determined the order in which the Bottom-level Factors were listed. Hence the name "Weighted Rankings". Finally, the Cumulative Scores -- obtained by summing the Weighted Scores in the same or earlier rows -- are shown in the rightmost column. By comparing a Cumulative Score with the total score (here, 76) for an ECOA, it is easy to see how much of the total score is accounted for by the Bottom-level Factors having Weighted Scores that exceed any specified level.

As an example: OPFOR has localized air superiority, and so the score for the Primary Attack ECOA is 100 points for the Bottom-level Factor LOCAL AIR SUPERIORITY. But LOCAL AIR SUPERIORITY (with a

Relative Weight of 0.29) is a subfactor of OPFOR FORCE FACTORS (Relative Weight 0.50), and that in turn is a subfactor of the Top-level Factor OPFOR COA (Relative Weight 1.00). Multiplying the Relative Weights  $0.29 \times 0.50 \times 1.00$  yields an Overall Weight of 0.145 for LOCAL AIR SUPERIORITY. Finally, multiplying the Primary Attack score for LOCAL AIR SUPERIORITY times the Overall Weight of the LOCAL AIR SUPERIORITY yields  $100 \times 0.145 = 14.5$  points. Out of a total score of 76 points for the Primary Attack ECOA, 14.5 points are attributable to OPFOR's having localized air superiority.

Bottom-level Factors	Overall Weight	PRIMARY	Weighted Score	Cumulative Score
LOCAL AIR SUPERIORITY	0.1450	100.00	14.50	14.50
MOBILITY DUE TO WEATHER	0.0500	100.00	5.00	19.50
OPFOR STRENGTH AND COND	0.0500	100.00	5.00	24.50
TOTAL NUM OF REGIMENTS	0.0458	100.00	4.58	29.08
NUMBER OF TANK	0.0343	100.00	3.43	32.51
NUMBER IN 1ST ECHELON	0.0280	100.00	2.80	35.31
KEY FRIENDLY TERRAIN	0.0435	60.00	2.61	37.92
TOTAL NUMBER ARTILLERY	0.0240	100.00	2.40	40.32
LT OR HEAVY DIVISION	0.0600	40.00	2.40	42.72
FRIENDLY C AND C	0.0440	50.00	2.20	44.92
FIELDS OF FIRE	0.0255	80.00	2.04	46.96

<More>

#### OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0				
Discrimination Analysis Menu					
<Esc> Quit Menu		1. Weighted Ranking for One ECOA			
<?> HELP		2. Difference in Weighted Rankings for Two ECOAs			
<PrtSc> Print Screen					

#### EXHIBIT 2.9-4

#### DISCRIMINATION ANALYSIS: WEIGHTED RANKINGS

Weighted Rankings for the Primary Attack ECOA. Only the first in a series of four (4) displays is shown here. To obtain the rest of the series, press <Ret> after each new display appears.

This display shows that the Bottom-level Factor LOCAL AIR SUPERIORITY contributes almost three times as much to the overall score for Primary Attack as the Bottom-level Factor, MOBILITY DUE TO WEATHER, that contributes second most. The contribution of each Bottom-level Factor may be observed by continuing the display (press <Ret>) over the several screens that it occupies.

Note that the weighted scores are expressed in points, not percentages. The weighted scores for all the Bottom-level Factors will sum to the appropriate ECOA Score -- here, 76.

Next consider a discrimination analysis for difference rankings between two ECOAs (Exhibit 2.9-5). Specifically, since Primary Attack and Secondary Attack are the most supported ECOAs, with Defend a poor third, consider the difference rankings for Primary vs. Secondary Attack. These are the main contenders, and, although AI/ENCOA favors Primary over Secondary Attack, we may wish to analyze more closely the reasons underlying this choice. Difference rankings allows us systematically to examine the effect of the Bottom-level Factors on this choice by listing the Bottom-level Factors in an order reflecting their contribution to the difference between ECOA Scores for Primary and for Secondary Attack.

```

|=====|
|          ECOAs Available for Discrimination Analysis:          |
|                                                                |
|          1. PRIMARY ATTACK                                     |
|          2. SECONDARY ATTACK                                   |
|          3. DEFEND                                             |
|          4. WITHDRAW                                           |
|                                                                |
|          Select first ECOA for analysis:                      |
|                                                                |
|=====|

```

```

                                OPFOR COA - Top-level Factor
-----Description-----|ECOAs Scores|
| Wgt: 1.00  #Subfactors: 5 | PRIMARY   SECONDARY   DEFEND   WITHDRAW |
| %Sol: 100   #Ans Ques: 40 |    76      61         43      9   |
| Sec:sect 1  #Unans Ques: 0 |-----|
|-----Discrimination Analysis Menu-----|
| <Esc> Quit Menu      1. Weighted Ranking for One ECOA      |
| <?> HELP             2. Difference in Weighted Rankings for Two ECOAs |
| <PrtSc> Print Screen |-----|
|-----|

```

EXHIBIT 2.9-5

DISCRIMINATION ANALYSIS: DIFFERENCE RANKINGS BETWEEN TWO ECOAs

To obtain this display: If you have not already done so, use <Ret> to step through the remaining "Weighted Rankings for the Primary Attack ECOA" displays (Exhibit 2.9-4). Then press <2> ("Difference in Weighted Rankings for Two ECOAs").

To interact using the present display: Press <1> to choose "Primary Attack" as the first ECOA for analysis. Then, at the prompt, press <2> to choose "Secondary Attack" as the second ECOA for analysis.



In Exhibit 2.9-6, TOTAL NUM OF REGIMENTS is listed before any of the other Bottom-level Factors because it makes a greater contribution to the difference between the ECOA Scores for Primary and for Secondary Attack, respectively. The actual amount of the difference, 4.58 is shown in the column headed "Weighted Difference".

The Weighted Difference itself is computed in a straightforward manner. First, the Overall Weight of the Bottom-level Factor is computed, as discussed above. Here the weighted difference is 0.0458 or, (accurate to two decimal places) 0.05, as shown in the second column. Secondly, the weighted ECOA scores for Primary and Secondary Attack are computed by multiplying the ECOA Score (100.00 for Primary Attack, 0.00 for Secondary Attack, as shown in columns 3 and 4 of the display) by the Overall Weight. The results are 4.58 for Primary Attack and 0.00 for Secondary. Finally, the difference, 4.58, is computed and displayed under Weighted Difference.

The Weighted Differences are accumulated in the last column under "Cumulative Difference". The Cumulative Differences increase as long as the Weighted Differences remain positive -- that is, as long as the weighted scores for Primary Attack remain greater than the weighted scores for Secondary Attack as we proceed down the list of Bottom-level Factors in the display.

Bottom-level Factors	Overall Weight	ECOA Scores		Weighted Difference	Cumulative Difference
		PRIMARY	SECONDARY		
TOTAL NUM OF REGIMENTS	0.0458	100.00	0.00	4.58	4.58
NUMBER OF TANK	0.0343	100.00	0.00	3.43	8.01
NUMBER IN 1ST ECHELON	0.0280	100.00	0.00	2.80	10.81
TOTAL NUMBER ARTILLERY	0.0240	100.00	0.00	2.40	13.21
OPFOR STRNGTH AND COND	0.0500	100.00	60.00	2.00	15.21
NUMBER OF SAM BTRYs	0.0192	100.00	0.00	1.92	17.13
NUMBER IN 2ND ECHELON	0.0191	100.00	0.00	1.91	19.04
LOCAL AIR SUPERIORITY	0.1450	100.00	90.00	1.45	20.49
OP MANEUVR GRP PRESENT	0.0192	100.00	50.00	0.96	21.45
BRIDGE MATERIAL	0.0120	100.00	20.00	0.96	22.41
DIVISION COMMAND POSTS	0.0120	100.00	50.00	0.60	23.01

<More>

#### OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt	#Subfactors	PRIMARY	SECONDARY	DEFEND	WITHDRAW
1.00	5	76	61	43	9
100	40				
Sec:sect 1	#Unans Ques: 0				

Discrimination Analysis Menu

- (Esc) Quit Menu
- (?) HELP
- (PrtSc) Print Screen

#### EXHIBIT 2.9-6

#### DISCRIMINATION ANALYSIS: DIFFERENCE RANKINGS BETWEEN THE PRIMARY

#### ATTACK ECOA AND THE SECONDARY ATTACK ECOA

Bottom-level Factors are listed in the order of their contribution to the (positive) difference between ECOA Scores for Primary and for Secondary Attack. That is, those Bottom-level Factors that most favor Primary Attack over Secondary Attack are listed first; Bottom-level Factors that most favor Secondary Attack are listed last. (See the continuation displays, obtainable by pressing <Ret>.)

Bottom-level Factors	Overall		ECOA Scores		Weighted Cumulative	
	Weight	PRIMARY	SECONDARY	Difference	Difference	
OBSERVATION OF OPFOR	0.0180	100.00	100.00	0.00	25.07	
FIELDS OF FIRE	0.0255	80.00	90.00	-0.25	24.82	
OBSTACLES	0.0225	50.00	70.00	-0.45	24.37	
FRIENDLY ACTION CAPAB	0.0175	70.00	100.00	-0.52	23.84	
KEY FRIENDLY TERRAIN	0.0435	60.00	80.00	-0.87	22.97	
FRNDLY LOGISTIC SUPPRT	0.0300	40.00	70.00	-0.90	22.07	
FRNDLY DIVSN STRENGTH	0.0300	40.00	70.00	-0.90	21.17	
LINE LEAST EXPECTATION	0.0198	0.00	50.00	-0.99	20.18	
SIZE OF CORPS RESERVES	0.0300	60.00	100.00	-1.20	18.98	
OBSERVE DUE TO WEATHER	0.0500	10.00	40.00	-1.50	17.48	
LT OR HEAVY DIVISION	0.0600	40.00	70.00	-1.80	15.68	

OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Secisect 1	#Unans Ques: 0				
Discrimination Analysis Menu					
<Esc> Quit Menu		1. Weighted Ranking for One ECOA			
<?> HELP		2. Difference in Weighted Rankings for Two ECOAs			
<PrtSc> Print Screen					

EXHIBIT 2.9-7

CONTINUATION OF PREVIOUS DISPLAY

Actually, several other continuations of the display in Exhibit 2.9-6 come between that display and the present one. Successive displays in the sequence may be obtained by pressing <Ret>.

The present display shows the Bottom-level Factor (namely, FIELDS OF FIRE) for which the Weighted Difference first becomes negative. FIELDS OF FIRE through LT OR HEAVY DIVISION gives a complete list of the Bottom-level Factors, which favor Secondary Attack over Primary Attack, ordered from those which favor Secondary Attack the least to those which favor it the most. The magnitude of these Weighted Differences shows how much each Bottom-level Factor favors Secondary Attack.

AI/ENCOA lets you see (Exhibit 2.9-8) the effect on ECOA scores of changing your answers to one or more of the questions. It also lets you determine the effect of changing the relative weight of a factor. Later, an example showing the effect of changing some answers will be shown in Exhibit 2.9-9. An example showing the effect of changing some of the relative weights will be shown in Exhibit 2.9-11.

1. Sensitivity Analysis  
on Answers/Scores ---- Allows answers to questions to be changed, and the effect of the changed answers on the ECOA scores to be seen.

2. Sensitivity Analysis  
on Weights ----- Gives the user the ability to see how changes in the relative weight of a factor affects the ECOA scores.

<Esc> -- Return to the analysis menu.

<?> -- Display this textual menu description.

<PrtSc> -- Copy the screen on the printer.

<PgUp>, <PgDn> -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

OPFOR COA - Top-level Factor

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0				
Sensitivity Analysis Menu-----					
<Esc> Quit Menu		1. Sensitivity Analysis for Answers			
<?> HELP		2. Sensitivity Analysis for Weights			
<PrtSc> Print Screen					

## EXHIBIT 2.9-8

### DISPLAY OF SENSITIVITY ANALYSIS MENU EXPLANATION

Obtain this display from the preceding one by typing first <Esc> then <2> ("Sensitivity Analysis"), and finally <?>.

The Sensitivity Analysis for Answers lets you see side-by-side comparisons of the ECOA scores, for each of the various options, corresponding to the original and the modified answer sets. See Exhibit 2.9-9 for an example of how to change the answers to two specific questions.

What effect does changing these two answers have on the ECOA scores? The display shows that all ECOA scores are lowered except for Defend, which is increased by 1 point. The explanation is that increasing FIELDS of FIRE to greater than 3000 meters decreases support for the Primary Attack, Secondary Attack, or Withdrawal ECOAs while slightly increasing support for the Defense ECOA. And changing FRIENDLY C AND C (i.e., Cover and Concealment into Friendly Sector) to "No Covered and Concealed Routes" reduces support for the Primary Attack and Secondary Attack ECOAs while (again) increasing support for the Defense ECOA. Taking into account the weights of the factors leads to the revised scores shown in the display.

Answers Modified for Analysis

(Number modified : 2)

Question Regarding: Fields of Fire

New Answer: Greater than 3000 Meters

Old Answer: Between 1500 and 3000 Meters

Question Regarding: Cover and Concealment into Friendly Sector

New Answer: No Covered and Concealed Routes

Old Answer: Many (3 or More) Totally Covered and Concealed Routes

\* Indicates Projected Score for each ECOA

OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 100	#Ans Ques: 40	76	61	43	9
Sec:sect 1	#Unans Ques: 0	74*	57*	44*	8*
Sensitivity Analysis Menu					
<Esc> Quit Menu		1. Sensitivity Analysis for Answers			
<?> HELP		2. Sensitivity Analysis for Weights			
<PrtSc> Print Screen					

EXHIBIT 2.9-9

SENSITIVITY ANALYSIS FOR ANSWERS

Starting from the preceding display, press <1> ("Sensitivity Analysis for Answers") to begin an interaction allowing you to modify some or all of the previously answered questions and determine the effect on the ECOA Scores. At the prompt,

Question Regarding : Fields of Fire

Current Status : Between 1500 and 3000 Meters

Modify? (y/n)

respond by pressing <y> <Ret>. In response to the next prompt press <1> <Ret> to characterize Fields of Fire as "Greater than 3000 Meters". Proceed similarly with the next question, characterizing "Cover and Concealment into Friendly Sector" as "No Covered and Concealed Routes". Don't modify any of the other answers: press <n> <Ret> in response to all the remaining "Modify?" prompts; or (better) press <Esc> ("Quit Menu"). In either case, the result will be the present display.

EXHIBIT 2.9-9 (cont.)

What effect did changing these two answers have on the ECOA scores? The display shows that all ECOA scores were lowered except for Defend, which was increased by 1 point. The explanation is that increasing FIELDS OF FIRE to greater than 3000 meters decreases support for the Primary Attack, Secondary Attack, or Withdrawal ECOAs while slightly increasing support for the Defense ECOA. And changing FRIENDLY C AND C (i.e., Cover and Concealment into Friendly Sector) to "No Covered and Concealed Routes" reduces support for the Primary Attack and Secondary Attack ECOAs while (again) increasing support for the Defense ECOA. Taking into account the weights of the factors leads to the revised scores shown in the display above.



Consider now the effect of changing the relative weight of OPFOR FORCE FACTORS. Starting from the display shown in Exhibit 2.9-9, press <2> to select "Sensitivity Analysis for Weights" from the Sensitivity Analysis Menu, as directed in Exhibit 2.9-10. Then continue with those directions to select OPFOR FORCE FACTORS in the red display window, pressing <Ret> after that selection has been made.

```

      | -TERRAIN FACTORS
      |
      | -FRIENDLY FORCE FACTORS
      |
      | -OPFOR FORCE FACTORS-----|
OPFOR COA-----|
      |
      | -WEATHER FACTORS
      |
      | -RISK FACTORS
      |
      | -CURRENT DISPOSITION
      |
      | -OPFOR STRNGTH AND COND*
      |
      | -TANKS IN 2ND ECHELON*
      |
      | -LOGISTIC SUPPORT OPFOR
      |
      | -OPFOR C AND C
      |
      | -LOCAL AIR SUPERIORITY*

```

OPFOR FORCE FACTORS - Subfactor of OPFOR COA

```

|-----Description-----| EDOA Scores-----|
| Wgt: 0.50  #Subfactors: 6 | PRIMARY  SECONDARY  DEFEND  WITHDRAW
| %Sol: 100   #Ans Ques: 20 | 98      49      21      5
| Sec:sect 1  #Unans Ques: 0 |
|-----Sensitivity Analysis Menu-----|
| <Esc> Quit Menu    1. Sensitivity Analysis for Answers
| <?> HELP          2. Sensitivity Analysis for Weights
| <PrtSc> Print Screen
|-----|

```

EXHIBIT 2.9-10

SENSITIVITY ANALYSIS FOR WEIGHTS

To obtain this display from the preceding display press <2> ("Sensitivity Analysis for Weights"). The following message will appear:

Using the arrow keys, move through the factor hierarchy to the factor you want to vary the weight on, then press <Ret>.

At this point, press first <—>, then <|>, and then <|> again. OPFOR FORCE FACTORS is highlighted.

The result is shown in Exhibit 2.9-11. Selected relative weights for OPFOR FORCE FACTORS, ranging from 0.00 to 1.00 in increments of 0.10, are shown there in one column of the display. In the next column to the right are shown the corresponding Overall Factor Weights; because OPFOR FORCE FACTORS is a subfactor of the Top-level Factor, both Relative and Overall Factor Weights are the same.

In the next four columns to the right, scores for the four ECOAs are recomputed for each of the selected relative weights for OPFOR FORCE FACTORS. High scores for each selected weight are followed by an asterisk. The results show that a Primary Attack is the most supported ECOA if the selected relative weight is .30 or higher. A Secondary Attack is most supported if the weight is .20 or lower.

The leftmost column summarizes information about the factor OPFOR FORCE FACTORS selected in Exhibit 2.9-10. The Relative Weight of this factor stored in the rule base is .50. This happens to be the same as one of the Selected Relative Factor Weights appearing in the second column; but the sameness is only a coincidence. The Overall Weight of OPFOR FORCE is the same as its Relative Weight; this is because OPFOR FORCE is a subfactor of the Top-level Factor. The Degree Solved is 100% because all questions relating to this factor have been answered. Finally, the ECOA Scores for this factor are given. The ECOA Scores for OPFOR FORCE coincide with the ECOA Scores for OPFOR COA within the row where the Selected Relative Factor Weight (in the second column of the present display) is 1.00; that is because, again, OPFOR FORCE is a subfactor of the Top-level Factor, OPFOR COA.

OPFOR FORCE Information	Selected Factor Wt		Projected ECOA Scores			
	Relative	Overall	PRIMARY	SECONDARY	DEFEND	WITHDRAW
Relative	0.00	0.00	55.26	73.45*	64.34	13.05
Weight : 0.50	0.10	0.10	59.50	70.98*	60.04	12.21
Overall	0.20	0.20	63.73	68.50*	55.74	11.37
Weight : 0.50	0.30	0.30	67.97*	66.03	51.43	10.53
Degree	0.40	0.40	72.21*	63.55	47.13	9.69
Solved : 100%	0.50	0.50	76.44*	61.08	42.83	8.84
	0.60	0.60	80.68*	58.61	38.53	8.00
ECOA Scores:	0.70	0.70	84.91*	56.13	34.23	7.16
PRIMARY : 96.09	0.80	0.80	89.15*	53.66	29.93	6.32
SECONDARY : 48.94	0.90	0.90	93.39*	51.18	25.63	5.46
DEFEND : 21.43	1.00	1.00	97.62*	48.71	21.33	4.64
WITHDRAW : 4.66						

\* indicates ECOA with highest score  
OPFOR COA - Top-level Factor

Description		ECOA Scores			
Wgt	#Subfactors	PRIMARY	SECONDARY	DEFEND	WITHDRAW
Wgt: 1.00	#Subfactors: 5	76	61	43	5
%Sol: 100	#Ans Ques: 40				
Sec:sect 1	#Unans Ques: 0				

Sensitivity Analysis Menu

(Esc) Quit Menu	1. Sensitivity Analysis for Answers
(?) HELP	2. Sensitivity Analysis for Weights
(PrtSc) Print Screen	

#### EXHIBIT 2.9-11

#### SENSITIVITY ANALYSIS FOR WEIGHTS (CONTINUATION)

To obtain this display from the preceding display, press <Ret>.

## 2.10 AOA Analysis

If one concludes that available information clearly supports a Primary or a Secondary Attack in a sector, then it is appropriate to ask, to what extent does the evidence support a Primary or a Secondary Attack along each possible Avenue of Approach (AOA) within the sector?

The present subsection addresses that question. The example considered is a continuation of the COA example in the preceding subsections.

To see a Cross AOA Summary we must read in the previously stored AOA information. Starting from the display in Exhibit 2.9-11, proceed as follows. Presently showing in the display is the Sensitivity Analysis Menu. Press <Esc> to go back to the Analysis Menu; press <Esc> again to go back to the Solution Menu, and once again to go to the Main Menu.

At the Main Menu press <3> ("Avenues of Approach"). When prompted:

For how many AOAs is the analysis to be run? (1-8)

press <2> (without <Ret>). At the prompt:

Name of AOA 1:

type: aoa 1 <Ret>; and at the prompt:

Name of AOA 2:

type: aoa 2 <Ret>. AI/ENCOA will then display the Solution Menu. The basic AOA information has been read in.

Next it will be necessary to answer questions. As with the COA demonstration before, it will save time to use a prestored set of answers. To do this, starting at the Solution Menu, press <5> ("Save/Restore Answers"). Then, at the Save/Restore Answer Set Menu,

press <2> ("Restore Previously Saved Answer Set"). You will be prompted:

Select the answer set you wish to restore

1 aoademo

2

Enter an answer set number:

Press <1> <Ret> to select aoademo. A message, "Saved answer set has been restored", will appear after 30 to 45 seconds.

Now that the AOA information and the answer set have been restored, we are ready to have a look at the Cross AOA Summary Display. At the Save/Restore Answer Set Menu, press <Esc> to go the Solution Menu. Then press <2> ("Display Results") and, at the Score Summarization Menu, press <4> ("Cross AOA Summary"). The display in Exhibit 2.10-1 will result.

AOA	Degree Solved	ECOA Scores	
		PRIMARY	SECONDARY
aoa 1	90%	52.53	56.27
aoa 2	90%	53.11	55.72

OPFOR COA - Top-level Factor

Description		ECOA Scores	
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY
%Sol: 90	#Ans Ques: 20	53	56
AOA:aoa 1	#Unans Ques: 6		
Score Summarization Menu			
<Esc> Quit Menu	1. Textual Summary		4. Cross AOA Summary
<?> HELP	2. Tabular Summary		
<PrtSc> Print Screen	3. Numerical Summary		

EXHIBIT 2.10-1

SUMMARY OF SCORES: CROSS AOA SUMMARY

See text for a description of how to arrive at this display.

Because several questions remained still unanswered among the stored answers, both AOAs were less than 100% "solved." Based on the answers that were available, AI/ENCOA gave 52.53 points to the ECOA of mounting a Primary Attack along aoa 1 and 56.27 points for mounting a Secondary Attack there. Similarly, it gave 53.11 and 55.72 points for mounting Primary or Secondary Attack, respectively, along aoa 2.

### **3.0 COMPENDIUM OF MENU OPTIONS**

This section systematically presents the menus and menu options that are available in AI/ENCOA. All available "HELP" displays are included here.

The AI/ENCOA menus may be organized as follows:

#### **Main Menu**

Solution Menu (for COAs)

Solution Menu (for AOAs)

Question Menu

Score Summarization Menu (for COAs)

Score Summarization Menu (for AOAs)

Analysis Menu

Discrimination Analysis Menu

Sensitivity Analysis Menu

Modify Sector Menu

Modify AOA Menu

Save/Restore Answer Set Menu

Each menu in the preceding list has a "HELP" display associated with it. The Modify Sector Menu alternates with the Modify AOA Menu, depending on whether a COA or an AOA evaluation is currently being conducted. There are similar slight differences (for AOAs vs. COAs) in the Solution and the Score Summarization Menus. These twelve menus, together with their associated "HELP" displays, are shown in Exhibits 3-1 through 3-12. Also given are some additional notes on the options available on each of the menus. In particular, whenever a menu option will result in another menu being displayed, the identity of the new menu is noted.



**\*\* Main Menu Explanation \*\***

1. Present Tutorial ---- Show a short tutorial explaining the basic concepts of AI/ENCOA.
  2. Course of Action ---- Runs the analysis that helps determine what the enemy is going to do.
  3. Avenue of Approach -- Runs the analysis that helps determine which way the enemy is going to approach.
- <Esc> -- Leave AI/ENCOA; go to DOS.  
    <?> -- Display this textual menu description.  
    <PrtSc> -- Copy the screen on the printer.  
    <PgUp>, <PgDn> -- Select sector or AOA.  
    Arrow Keys move through factor hierarchy.

```
|-----|
|               |
|               |
|-----|
|Main Menu-----|
| <Esc> Quit AI/ENCOA 1. Present Tutorial |
| <?> HELP           2. Courses of Action |
| <PrtSc> Print Screen 3. Avenues of Approach |
|-----|
```

**EXHIBIT 3-1**

**MAIN MENU, AND ASSOCIATED "HELP" DISPLAY"**

**Notes on options:**

- <1> ("Present Tutorial") See Section 2.4.
- <2> ("Courses of Action") Reads in information appropriate to doing a COA evaluation. Leads to the Solution Menu shown in Exhibit 3-2.
- <3> ("Avenues of Approach") Reads information appropriate to doing an AOA evaluation. Leads to the Solution Menu shown in Exhibit 3-3.

**\*\* AI/ENCOA Solution Menu Explanation \*\***

1. Answer Questions ----- Answer the questions for this factor. You can also modify individual answers or erase all answers.
2. Display Results ----- Display results of factor's scores for the ECOAs.
3. Analyze Results ----- Permit discrimination or sensitivity analysis.  
 (Discrimination: which factors support the different ECOAs?)  
 (Sensitivity: how sensitive are the results to changes in the answers to certain questions or to the relative weights placed on the factors?)
4. Modify Sectors or AOA - Add or rename Sectors or AOAs.
5. Save/Restore Answers -- Save this ECOAs answers, or restore a previous one.  
 (Esc) -- Return to the main menu.  
 (?) -- Display this textual menu description.  
 (PrtSc) -- Copy the screen on the printer.  
 (PgUp), (PgDn) -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

I-Description-----		IECOA Scores-----			
I Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
I %Sol: 0	#Ans Ques: 0	0	0	0	0
I Sec:	#Unans Ques: 40				
I-Solution Menu-----					
I (Esc) Quit Menu	1. Answer Questions	4. Modify Sectors			
I (?) HELP	2. Display Results	5. Save/Restore Answers			
I (PrtSc) Print Screen	3. Analyze Results				

**EXHIBIT 3-2**

**SOLUTION MENU FOR COAs, AND ASSOCIATED "HELP" DISPLAY.**

**Notes on options:**

- <Esc> Returns to Main Menu (Exhibit 3-1)
- <1> ("Answer Questions") Goes to Question Menu (Exhibit 3-4)
- <2> ("Display Results") Goes to Score Summarization Menu (Exhibit 3-5)
- <3> ("Analyze Results") Goes to Analysis Menu (Exhibit 3-7)
- <4> ("Modify Sectors") Goes to Modify Sector Menu (Exhibit 3-10)
- <5> ("Save/Restore Answers") Goes to Save/Restore Answer Set Menu (Exhibit 3-12)

**\*\* AI/ENCOA Solution Menu Explanation \*\***

1. Answer Questions ----- Answer the questions for this factor. You can also modify individual answers or erase all answers.
2. Display Results ----- Display results of factor's scores for the ECOAs.
3. Analyze Results ----- Permit discrimination or sensitivity analysis.  
 (Discrimination: which factors support the different ECOAs?)  
 (Sensitivity: how sensitive are the results to changes in the answers to certain questions or to the relative weights placed on the factors?)
4. Modify Sectors or AOA - Add or rename Sectors or AOAs.
5. Save/Restore Answers -- Save this ECOAs answers, or restore a previous one.  
 (Esc) -- Return to the main menu.  
 (?) -- Display this textual menu description.  
 (PrtSc) -- Copy the screen on the printer.  
 (PgUp), (PgDn) -- Select sector or AOA.  
 Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

I-Description-----		IECOA Scores-----	
I Wgt: 1.00	#Subfactors: 5	I PRIMARY	SECONDARY
I %Sol: 0	#Ans Ques: 0	I 0	0
I AOA:	#Unans Ques: 26	I	
I-Solution Menu-----			
I (Esc) Quit Menu	1. Answer Questions	4. Modify AOAs	
I (?) HELP	2. Display Results	5. Save/Restore Answers	
I (PrtSc) Print Screen	3. Analyze Results		

**EXHIBIT 3-3**

**SOLUTION MENU FOR AOAs AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

- <Esc> Returns to Main Menu (Exhibit 3-1)
- <1> ("Answer Questions") Goes to Question Menu (Exhibit 3-4)
- <2> ("Display Results") Goes to Score Summarization Menu (Exhibit 3-6)
- <3> ("Analyze Results") Goes to Analysis Menu (Exhibit 3-7)
- <4> ("Modify AOAs") Goes to Modify AOA Menu (Exhibit 3-11)
- <5> ("Save/Restore Answers") Goes to Save/Restore Answer Set Menu (Exhibit 3-12)

**\*\* Question Menu Explanation \*\***

1. Answer All Questions-- Answer questions pertaining to the current factor. Questions can be skipped by simply hitting <return>.
  2. Unanswered Questions-- Answer questions not already answered, if any, which pertain to the current factor.
  3. Modify Answers ----- One by one, inspect and possibly change answers to pertinent questions.
  4. Display Answers ----- Show each attribute relevant to the current factor and its status.
  5. Reset Answers ----- Erase pertinent question answers, effectively resetting the portion of the hierarchy dependent on them.
- <Esc> -- Return to the solution menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select sector or AOA.

**OPFOR COA - Top-level Factor**

Description-----		IECOA Scores-----				
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
%Sol: 0	#Ans Ques: 0	0	0	0	0	
Sec:	#Unans Ques: 40					

-----  
 Question Menu:-----  
 <Esc> Quit Menu    1. Answer All Questions    4. Display Answers  
 <?> HELP        2. Unanswered Questions    5. Erase Answers  
 <PrtSc> Print Screen    3. Modify Answers  
 -----

**EXHIBIT 3-4**

**QUESTION MENU, AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

- <Esc> Returns to Solution Menu (Exhibit 3-2 or 3-3)
- <1> ("Answer All Questions") Leads to an interaction much like that for <2>. Cf. of Section 2.7.
- <2> ("Unanswered Questions") See Section 2.7
- <3> ("Modify Answers") Leads to an interaction somewhat like that for <2>; as a safety feature, the user is prompted: "Modify? (y/n)", and must respond "y" before being allowed to modify an answer
- <4> ("Display Answers") Displays answers to questions, without permitting them to be modified
- <5> ("Erase Answers") Resets all questions to the status of being unanswered.

**\*\* Score Summarization Menu Explanation \*\***

1. Textual Summary ----- Brief English description of results.
  2. Tabular Summary ----- Display for the current factor and its subfactors:  
the degree solved, factor weight, and an indication  
of the options with strong support.
  3. Numerical Summary ---- Display for the current factor and its subfactors:  
the degree solved, factor weight, and option scores.
  4. Cross Region Summary - Summary of scores for the current factor across  
defined regions.
- <Esc> -- Return to the solution menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select sector or AOA.  
 Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

I-Description-----		IECOA Scores-----				
I Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
I %Sol: 0	#Ans Ques: 0	0	0	0	0	
I Sec:	#Unans Ques: 40					
I-Score Summarization Menu-----						
I <Esc> Quit Menu	1. Textual Summary				4. Cross Sector Summary	
I <?> HELP	2. Tabular Summary					
I <PrtSc> Print Screen	3. Numerical Summary					

**EXHIBIT 3-5**

**SCORE SUMMARIZATION MENU FOR COAs AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

- <Esc> Returns to Solution Menu (Exhibit 3-2)
- <1> ("Textual Summary") See Section 2.8, especially  
Exhibits 2.8-2 through 2.8-5)
- <2> ("Tabular Summary") See Section 2.8, especially  
Exhibit 2.8-6
- <3> ("Numerical Summary") See Section 2.8, especially  
Exhibit 2.8-7
- <4> ("Cross Sector Summary") Cf. Section 2.10, where a  
similar summary display is given  
for AOAs.

**\*\* Score Summarization Menu Explanation \*\***

1. Textual Summary ----- Brief English description of results.
2. Tabular Summary ----- Display for the current factor and its subfactors: the degree solved, factor weight, and an indication of the options with strong support.
3. Numerical Summary ---- Display for the current factor and its subfactors: the degree solved, factor weight, and option scores.
4. Cross Region Summary - Summary of scores for the current factor across defined regions.

<Esc> -- Return to the solution menu.

<?> -- Display this textual menu description.

<PrtSc> -- Copy the screen on the printer.

<PgUp>, <PgDn> -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

OPFOR COA - Top-level Factor

I-Description-----		IECOA Scores-----	
I Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY
I %Sol: 0	#Ans Ques: 0	0	0
I AOA:	#Unans Ques: 26		
I-Score Summarization Menu-----			
I <Esc> Quit Menu	1. Textual Summary	4. Cross AOA Summary	
I <?> HELP	2. Tabular Summary		
I <PrtSc> Print Screen	3. Numerical Summary		

**EXHIBIT 3-6**

**SCORE SUMMARIZATION MENU FOR AOAs AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

<Esc> Returns to Solution Menu (Exhibit 3-3)

<1> ("Textual Summary") Cf. Section 2.8, especially Exhibits 2.8-2 through 2.8-5

<2> ("Tabular Summary") Cf. Section 2.8, especially Exhibit 2.8-6

<3> ("Numerical Summary") Cf. Section 2.8, especially Exhibit 2.8-7

<4> ("Cross AOA Summary") See Section 2.10

**\*\* Analysis Menu Explanation \*\***

1. Discrimination Analysis - Generate displays indicating key elements of a factor's score for a given option, or the key differences between two option scores.
2. Sensitivity Analysis ---- Perform analyses of the current factor's score by examining its sensitivity to the weights of descendant factors and to the answers of relevant questions.

<Esc> -- Return to the solution menu.

<?> -- Display this textual menu description.

<PrtSc> -- Copy the screen on the printer.

<PgUp>, <PgDn> -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

Description-----		IECOA Scores-----			
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 0	#Ans Ques: 0	0	0	0	0
Sec:	#Unans Ques: 40				
Analysis Menu-----					
<Esc> Quit Menu		1. Discrimination Analysis			
<?> HELP		2. Sensitivity Analysis			
<PrtScr> Print Screen					

**EXHIBIT 3-7**

**ANALYSIS MENU, AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

<Esc> Returns to Solution Menu (Exhibit 3-2 or 3-3)

<1> ("Discrimination Analysis") Goes to Discrimination Analysis Menu (Exhibit 3-8)

<2> ("Sensitivity Analysis") Goes to Sensitivity Analysis Menu (Exhibit 3-9)

**\*\* Discrimination Analysis Menu Explanation \*\***

1. **Weighted Ranking** --- For one ECOA, rank orders the bottom-level factors in the hierarchy according to their weighted scores (that is, wts x scores) so that you can see how much each bottom-level factor supports the ECOA.
  2. **Difference Rankings** --- For two ECOAs, rank orders the bottom-level factors in the hierarchy by their difference in weighted scores so you can see how much each bottom-level factor supports each of the two ECOAs. Positive values indicate that the first ECOA has a higher weighted score; Negative values indicate that the second has the higher weighted score.
- <Esc> -- Return to the analysis menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select sector or AOA.  
 Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

Description		ECOAs Scores				
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
%Sol: 0	#Ans Ques: 0	0	0	0	0	
Sec:	#Unans Ques: 40					

Discrimination Analysis Menu  
 <Esc> Quit Menu      1. Weighted Ranking for One ECOA  
 <?> HELP            2. Difference in Weighted Rankings for Two ECOAs  
 <PrtSc> Print Screen

**EXHIBIT 3-8**

**DISCRIMINATION ANALYSIS MENU, AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

- <Esc> Returns to Analysis Menu (Exhibit 3-7)
- <1> ("Weighted Ranking for One ECOA") See Section 2.9, especially Exhibits 2.9-3 and 2.9-4
- <2> ("Difference in Weighted Rankings for Two ECOAs") See Section 2.9, especially Exhibits 2.9-5 and 2.9-6.



## \*\* Sensitivity Analysis Menu Explanation \*\*

1. Sensitivity Analysis  
on Answers/Scores ---- Allows answers to questions to be changed, and the effect of the changed answers on the ECOA scores to be seen.

2. Sensitivity Analysis  
on Weights ----- Gives the user the ability to see how changes in the relative weight of a factor affects the ECOA scores.

<Esc> -- Return to the analysis menu.

<?> -- Display this textual menu description.

<PrtSc> -- Copy the screen on the printer.

<PgUp>, <PgDn> -- Select sector or AOA.

Arrow Keys move through factor hierarchy.

OPFOR COA - Top-level Factor

Description		IECOA Scores				
Wgt: 1.00	#Subfactors: 5	PRIMARY	SECONDARY	DEFEND	WITHDRAW	
%Sol: 0	#Ans Ques: 0	0	0	0	0	
Sec:	#Unans Ques: 40					

Sensitivity Analysis Menu	
<Esc> Quit Menu	1. Sensitivity Analysis for Answers
<?> HELP	2. Sensitivity Analysis for Weights
<PrtSc> Print Screen	

## EXHIBIT 3-9

### SENSITIVITY ANALYSIS MENU, AND ASSOCIATED "HELP" DISPLAY

#### Notes on options:

<Esc> Returns to Analysis Menu (Exhibit 3-7)

<1> ("Sensitivity Analysis for Answers")  
See Section 2.9, especially Exhibit 2.9-9

<2> ("Sensitivity Analysis for Weights")  
See Section 2.9, especially Exhibits 2.9-10 and 2.9-11

**\*\* Modify Sector Menu Explanation \*\***

1. Add New Sector ----- Add an additional sector to the analysis.
  2. Rename a Current Sector -- Change the name of a sector currently in use without changing its answers.
- <Esc> -- Return to the solution menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select sector or AOA.  
 Arrow Keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

```

-----
|Description-----|IECOA Scores-----|
|Wgt: 1.00  #Subfactors: 5 | PRIMARY  SECONDARY  DEFEND  WITHDRAW
| %Sol: 0    #Ans Ques: 0 |    0      0      0      0
| Sec:      #Unans Ques: 40 |
|-----|
|Modify Sector Menu-----|
|  <Esc> Quit Menu      1. Add New Sector
|  <?> HELP            2. Rename a Current Sector
|<PrtSc> Print Screen
|-----|

```

**EXHIBIT 3-10**

**MODIFY SECTOR MENU, AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

- <Esc> Return to Solution Menu (Exhibit 3-2)
- <1> ("Add New Sector") Leads to an interaction permitting a new division-wide sector to be named and added to the analysis
- <2> ("Rename a Current Sector") Leads to an interaction permitting a division-wide sector currently in the analysis to be given a different name

**\*\* Modify AOA Menu Explanation \*\***

1. Add New AOA ----- Add an additional AOA to the analysis.
  2. Rename a Current AOA ----- Change the name of a AOA currently in use without changing its answers.
- <Esc> -- Return to the solution menu.  
 <?> -- Display this textual menu description.  
 <PrtSc> -- Copy the screen on the printer.  
 <PgUp>, <PgDn> -- Select region or AOA.  
 Arrow Keys move through factor hierarchy.

```

                                OPFOR COA - Top-level Factor
-----
|Description-----|EOA Scores-----|
| Wgt: 1.00  #Subfactors: 5 | PRIMARY  SECONDARY
| %Sol: 0    #Ans Ques: 0 | 0        0
| AOA:      #Unans Ques: 26 |
|-----|-----|
|Modify AOA Menu-----|
| <Esc> Quit Menu      1. Add New AOA
| <?> HELP            2. Rename a Current AOA
|<PrtSc> Print Screen
|-----|-----|

```

**EXHIBIT 3-11**

**MODIFY AOA MENU, AND ASSOCIATED "HELP" DISPLAY**

**Notes on options:**

- <Esc> Return to Solution Menu (Exhibit 3-3)
- <1> ("Add New AOA") Leads to an interaction permitting a new AOA to be named and added to the analysis
- <2> ("Rename a Current AOA") Leads to an interaction permitting an AOA currently in the analysis to be given a different name

**\*\* Save/Restore Answer Set Menu Explanation \*\***

1. Save Current Answer Set -- Save the current set of answers by writing them into a file.
2. Restore Previously Saved Answer Set -- Restores the answers to the questions that were previously saved.
3. Remove a Previously Saved Answer Set -- Removes a list of previously stored answers.

<Esc> -- Return to the solution menu.

<?> -- Display this textual menu description.

<PrtSc> -- Copy the screen on the printer.

<PgUp>, <PgDn> -- Select sector or AQA.

Arrow keys move through factor hierarchy.

**OPFOR COA - Top-level Factor**

Description-----		IECOA Scores-----				
Wgt: 1.00	#Subfactors: 5	1	PRIMARY	SECONDARY	DEFEND	WITHDRAW
%Sol: 0	#Ans Ques: 0	1	0	0	0	0
Sec:	#Unans Ques: 40	1				
Save/Restore Answer Set Menu-----						
<Esc> Quit Menu		1.	Save Current Answer Set			
<?> HELP		2.	Restore Previously Saved Answer Set			
<PrtSc> Print Screen		3.	Remove Previously Saved Answer Set			

**EXHIBIT 3-12**

**SAVE/RESTORE ANSWER SET MENU, AND ASSOCIATED "HELP" DISPLAY**

<Esc> Returns to Solution Menu (Exhibit 3-2 or 3-3)

<1> ("Save Current Answer Set") Leads to an interaction permitting the current answer set to be saved

<2> ("Restore Previously Saved Answer Set") Leads to an interaction permitting a previously saved answer set to be restored. See Section 2.7

<3> ("Remove Previously Saved Answer Set") Leads to an interaction permitting a previously saved answer set to be saved no longer.

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## Appendix A

### Statement of the Demonstration Problem

Appendix A contains reprints of two U.S. Army Intelligence Center and School papers (SE 001-I and SE 001-II) describing the problem used for demonstration purposes in the present User's Manual. This problem was originally used as a training exercise for intelligence analysts (SE001-I). Although some of the information in SE001-I is not relevant to the present demonstration (see SE001-I, Section 2), for completeness the entire contents of both papers are retained.

US INTELLIGENCE CENTER AND SCHOOL  
FORT HUACHUCA, AZ 85613

SE  
001-I

1. Introduction

You are an analyst in the All-Source Production Section (ASPS) of the 52 ID (M) Tactical Operations Center Support Element (DTCSE). The 52 ID (M) has deployed to its general defense positions (GDP) and is awaiting a major attack from the 99 TA and its four subordinate divisions across the International German Border (IGB). It is 031945JULXX. All three Bdes of the 52 ID(M) are on line from north to south: 1st, 2d, and 3d. 1st Bde is at 95 percent strength, 2d Bde at 97 percent strength, and 3d Bde at 93 percent strength. Morale is high. Troops and equipment are in excellent condition. Division reserves in assy areas: TF 1-13 Mech, NB2330, TF 1-32 Mech, NB 1025, and TF 2-68 AR, NB 2330. Logistic support is very good along the autobahns and highways B254, B62, B324 and B27; however, on less travelled/protected secondary roads and trails, Spetznaz and terrorist activity have been noted. US Command and Control is very good with Div CP at NB239203; 1st Bde CP at NB558413; 2d Bde CP at NB555275; and 3d Bde CP at NB523129. Your mission is to analyze and prioritize the possible enemy courses of action (CA) in the division sector prior to and after the start of hostilities.

2. Requirements

Given an Apple IIE computer with the Enemy Courses of Action-Bayesian Analysis for Updating Dynamic Information (ENCOA-BAUDI) software, one 1:50,000 map, one 1:50,000 overlay of the 52 ID (M) sector, one 1:50,000 overlay of the current enemy situation, and a description of the terrain and avenues of approach into the division's sector, you will:

- (1) Before receiving any intelligence messages: write a 100-200 word statement justifying why you rank ordered each AA.
- (2) After receiving each intelligence message and enemy overlay: update the rank order of each AA.
- (3) After receiving all intelligence messages write a 100-200 word statement justifying why you rank ordered each AA.
- (4) Save all probabilities on the floppy disk.
- (5) Fill out Army Research Institute (ARI) questionnaire.



US ARMY INTELLIGENCE CENTER AND SCHOOL  
FORT HUACHUCA, AZ 85613

1. GENERAL DESCRIPTION OF THE DIVISION AREA.

SE  
001-II

a. Climatic or Weather Conditions.

(1) Climate. The climate of Western Germany during the anticipated period of operations (summer) is characterized by clear skies, mild temperatures, some afternoon thunderstorms with heavy rain and high winds and light winds during other periods.

(2) Weather. Long-range weather forecast for July, August, September and October.

- (a) Precipitation. 10-16 inches expected over a four-month period. Most locations average 5-7 days a month with thunderstorms. Although lasting only an hour or two at any location, these storms can be severe with strong gusty winds and large amounts of precipitation in short periods of time.
- (b) Fog. Some isolated cases of early morning fog in the lower valleys.
- (c) Temperature. Mean daily temperature should be 72 to 51 F.
- (d) Wind. Prevailing surface wind from the southwest at 5 knots.
- (e) Cloudiness. Some stratus during the early morning hours and some cumulus in the afternoon.
- (f) Atmospheric pressure. Average about 29.5 inches of mercury.
- (g) Moon. Annex A (Moon and Light Data). (Omitted.)
- (h) Light data. Annex A (Moon and Light Data). (Omitted.)

b. Terrain.

(1) Relief and Drainage Systems. The area is drained by the WERRA, HAUNE, FULDA, and SCHWALM River systems. These systems run generally north-south creating a series of terrain compartments throughout the area. The tributaries of these river systems further divide the area into smaller compartments running northeast to southwest, northwest to southeast, and west to east. The terrain in the northern half of the area consists of a series of forested hill masses broken by the drainage systems. East of the FULDA River, the terrain in the northern half of the area is dominated by a series of hill masses broken by streams and low ground. The main series of hill masses in this area is the high ground bounded by RANSBACH (NB 6431), HONEBACH (NB 6643), WEITERODE (NB 5745), and EITRA (NB 5229). This same type of terrain occurs on

the west side of the FULDA River all the way to the ridge complex consisting of Hill 487 (NB 3531). Beyond this ridge complex the forest cover begins to get more open and the terrain becomes less steep and more rolling. The last ridge system before the town of NEUKIRCHEN, consisting of Hill 536 (NB 2944), Hill 634 (NB 2940), and Hill 588 (NB 3037), and Hill 533 (NB 3031), has less forest cover than any of the other high ground to the east. Beyond this ridge system, the terrain becomes more gentle and rolling and less forested. The terrain in the southern half of the area of operations consists of a series of well defined ridge systems separated by drainage systems and relatively flat, open, unforested terrain. On the east side of the FULDA River, the ridge systems are bounded by WESHUSEN (NB 6228), LANDERSHAUSEN (NB 5728) and come to a point at HOFHASCHENBACK (NB 6010) at the extreme southern end of the area. To the west of this complex the terrain is flat, open to gently rolling, until the next complex of ridges which is bisected by the HAUNE River. On the northeast side of the HAUNE, the ridge complex consisting of Hill 454 (NB 5226) to Hill 524 (NB 4922) has a relatively gentle slope on its east side and steep slope leading down to the HAUNE River. Between the HAUNE and FULDA Rivers there are two forested ridges separated by open, rolling terrain. Beyond the FULDA River, the terrain rises into a relatively steep, forested ridge mass that blocks the approaches to ALSFELD and LAUTERBACH. This ridge runs from Hill 400 (NB 3727), Hill 438 (NB 3723) to Hill 484 (NB 3516) and Hill 472 (NB 3212). Beyond this ridge lie the approaches to LAUTERBACH and more gentle, rolling open terrain. Also beyond this ridgeline, lies ridgeline Hill 472 (NB 2626) to Hill 420 (NB 2614) which blocks the approaches to ALFELD. The FULDA and WERRA Rivers are the largest rivers in the area of operations and thus, the ones which would most hamper military operations. They are both generally between 45 and 90 meters wide and are fordable except during periods of very high water. Between KOHLHAUSEN (NB 4831) and KAMMERZELL (NB 4505) the FULDA River narrows to between 20 and 30 meters at certain crossing sites.

All other stream and tributary systems within the area are fordable, steepness of banks is a consideration in some areas, especially along the FULDA-HAUNE from MECKLAR (NB 5441) to BURGHAUN (NB 5116). For the most of the smaller streams, bank slopes are more of a problem than the actual watercourse itself. River and stream bottoms will not hinder fording. They are mostly of sand and gravel.

(2) Vegetation. Wooded areas are more predominant in the northern half of the area. All of the wooded areas are well tended, with the underbrush cleared, periodically thinned, and numerous one-vehicle wide access lanes running through them. These are both coniferous and deciduous. Wooded areas in both the northern and southern halves of the area of operations consist of croplands, pasturelands, and open fields, with some bogs and marshes along streams and rivers.

(3) Surface Materials. Although there are small patches of soggy peat and slow-drying clay along the streams, sandy, silty and other quick drying soils predominate throughout the area. Soils would affect crosscountry movement little except on steep slopes and during periods of precipitation.

(4) Manmade Features. The principal large towns within the area are BAD HERSFELD, HUNSFELD, SCHLITZ, LAUTERBACH, ALSFELD and TRESAZIEGENHAIN. These are modern, built-up areas which dominate the road network in the entire area of operations. Two autobahns run throughout the area, one northeast to southwest and one north-south. Terrain on either side of these roadways would restrict any large-scale movement down them and on either side, although the roads

themselves are excellent four-lane, divided, controlled access highways. In addition, the entire area is crisscrossed by a network of primary and secondary hard-surfaced three and two-lane roads. In addition to these, there are numerous two and one-lane forest trails which are light duty gravel surfaced roads. These trails provide access through the numerous stands of forest throughout the area of operations. Bridges on hard surfaced roads throughout the area are capable of sustaining class 60 traffic. Built-up areas within the area of operations range from the modern, medium-sized towns mentioned above to small villages consisting of a few closely spaced stone houses and cobblestone streets. In the event of a conflict in the area, the rail system throughout the area, although modern, would probably not contribute much to operations in the forward area of conflict.

## 2. MILITARY ASPECTS OF THE AREA

### A. Tactical Aspects.

#### (1) Concealment and cover.

(a) Relief. The sharper relief in the northern half of the area provides extensive cover and concealment from direct fire and ground level observation. The terrain also offers numerous defilade positions which would serve well as mortar and artillery positions. The sharp relief will also provide some protection from the effects of nuclear weapons detonated on the other sides of ridges and hill masses but will accentuate the effects of those detonated in the same valleys occupied by military forces. The relief will also provide numerous positions for tanks firing from hill defilade. The terrain in the southern portion of the area is somewhat more open and will provide somewhat less cover, concealment, and protection from the effects of nuclear weapons but will still provide ample protection from direct observation, direct fire, and defilade positions for artillery, tank, support, and other units.

(b) Vegetation. All of the heavily wooded area through out the area of operations are forests which are managed in accordance with FRG forestry standards and hence have had all underbrush cleared away. These areas afford excellent concealment for large units and some protection from the thermal effects of nuclear weapons but little cover. The open areas are croplands or meadows and will afford little concealment and only that cover offered by relief.

(c) Manmade features. Modern buildings of steel and reinforced concrete construction in the large build-up areas would provide some protection from the effects of nuclear weapons except blast close enough to affect the rigidity of the building's frame or foundation. All buildings will provide some protection from either conventional or nuclear secondary blast effects and fragmentation but not direct conventional hits or close nuclear bursts.

#### (2) Observation and fire.

(a) Weather conditions. Weather conditions during the anticipated period of operations will hinder observation little, either from the air or the ground.

(b) Relief. Observation from the topographic crests of the highest hill masses will be somewhat restricted due to the forest cover and the gentler slopes near the topographic crests masking observation all the way down

slopes of hills. Observation from either open areas or the edges of forested areas closer to the military crests of hills out to the gentler, more open areas should be good to excellent with better observation generally in the southern half of the area. Fields of fire for flat trajectory weapons, especially tank cannon, are generally more prevalent in the southern half of the area than in the northern half of the area. Fields of fire are generally the best in the southeastern portion of the area east of the HUNE River.

(c) Vegetation. In wooded areas, vegetation will restrict visibility to between 100 and 300 meters except along lanes and roads for ground level observation. Forest cover will also restrict observation. Vegetation will similarly restrict fields of fire within wooded areas but not meadowland and cropland. Throughout much of the area, especially the northern half of the area, vegetation and relief will combine to restrict observation and fields of fire to a significant degree.

(d) Manmade features. The higher buildings on the edges of built-up areas will provide good to excellent observation points but buildings within built-up areas will restrict observation and fields of fire greatly.

### (3) Obstacles.

(a) Relief. The drainage system of the FULDA, HAUNE, WERRA and SCHWALM Rivers creates obstacles for movement, although only the FULDA, HAUNE and WERRA are wide and deep enough to present significant problems, and even they are fordable. The steep relief associated with the banks of the drainage systems throughout the area is likely to be more of a problem than the rivers themselves. The relief associated with the hill masses in the northern half of the area is also going to provide a serious obstacle to movement. Relief in the southern half of the area is somewhat gentler, but the ridge system between the FULDA River and the town of GREBENAU (NB 3320) in the southern half of the area will also restrict and canalize movement within the area. The drainage systems generally run cross compartment to the desired avenues of approach into the area, and their tributaries generally canalize movement throughout.

(b) Vegetation. Heavily wooded areas are crosscut with numerous lanes and trails and will not generally be obstacles to movement, except that they will impede the rapid movement of large armored and mechanized formations. Forests will become obstacles if nuclear weapons are used and tree blowdown occurs. Any combination of forest and sharp relief will generally create an obstacle to movement.

(c) Surface materials. Surface materials in stream bottoms do not generally impede fording operations, although the marshy lands on either side of streambeds will generally act as obstacles. This is especially true along the WERRA, FULDA, and HAUNE Rivers from the central to the northern portions of the area as the width of these rivers increases. Wet croplands and pasturelands will generally impede the movement of both wheeled and tracked vehicles in off-road movements.

(d) Manmade Features. All built-up areas may generally be considered to be obstacles to rapid movement. Most of the smaller towns and villages in the area can be bypassed. The towns of BAD HERSFELD, HUNSFELD, and SCHLITZ, because of their association with other significant relief features, would block the advances of forces moving along axis of advance through them and would split up or canalize these formations.

(4) Key Terrain Features. The key terrain within the division's AO is broken down into two areas with the FULDA River being the dividing line.

(a) The Western Sector.

1 The high ground along the east bank of the FULDA River is key to the defense of this area. From the high ground vicinity Hill 478 (NB 5143) to the GREBENAU Forest (NB 3719), most fording sites across the river can be monitored and/or defended. Key areas within this first defensive line include:

a High ground west and north of BAD HERSFELD which controls the avenues of approach from that major communications center.

b Hills 403 (NB 4330) and 352 (NB 4027) which are adjacent to the best avenues of approach into our area. All of the terrain on the west bank of the FULDA, mentioned above is dominated by the eastern bank.

2 The southern flank of our defense is hinged upon the high ground to the south of SCHLITZ. This area controls possible fording sites below the GREBENAU Forest, the avenues of approach around SCHLITZ, and the FULDA - ANGERSBACH - LAUTERBACH axis of advance. This key terrain is outlined by Hills 386 (NB 4113), 429 (NB 3708), and 406 (NB 4007).

3 A second line of defense west of the FULDA Valley would be centered around SCHLHERZBERG (NB 3224) and RIMBERG (NB 3327). These two hill masses effectively control the major avenues of advance through the division's sector.

4 To the north, two parallel lines of high ground become the key terrain associated with the second line of defense. These run from Hills 462 (NB 3147), 553 (NB 3542), 636 (NB 3637), and 487 (NB 3531); and from Hills 524 (NB 2944), 624 (NB 3040), 567 (NB 3136) and 533 (NB 3031). They cover the major road networks and provide interior lines for our forces.

5 To the south, the second line of defense would be around the key terrain associated with Hills 494 (NB 3312), 388 (NB 3309), and 345 (NB 3613). This area dominates the enemy's avenues of approach below the GREBENAU Forest through SCHLITZ and from FULDA - ANGERSBACH - LAUTERBACH. Key terrain features 3, 4, and 5 are the last defensive positions prior to the TREYSA - ALFELD - LAUTERBACH (TAL) Line.

6 West of the TAL Line, the key terrain is the high ground west of the SCHWALM River. There terrain's relief and lack of vegetation provides the defender good observation and fields of fire.

(b) The Easter Sector.

1. The high ground along the east bank of the FULDA River will present not only an immediate obstacle but a key element to the defense of the river. This high ground dominates not only the FULDA Valley and all fording sites, but also positions on the western bank. It controls all avenues of advance into the WERRA and ULSTER River valleys. Key points along this terrain include Hill 327 (NB 5843) which controls the low ground around EEBRA, Hills 340 (NB 5337) and 458 (NB 5332) which dominates the BAD HERSFELD area. Other

important points include Hills 473 (NB 4526), 398 (NB 4323), and 376 (NB 4512).

2. A possible second line of defense could be developed along the high ground associated with Hills 409 (NB 5428); 524 (NB 4922) and 421 (NB 4719). This line of hills dominates several avenues of approach.

3. The first defensive positions west of the EAST GERMAN border is the key terrain along Hills 480 (NB 5939), 524 (NB 6136), 511 (NB 6232), 630 (NB 6226), 525 (NB 5721), 553 (NB 5918), and 572 (NB 5912). This terrain provides a commanding position over the low land to the east including the major communication centers of HUNFELD, EITERFELD, and SCHENKLENGESFELD.

4. Within the EAST GERMAN border, Hills 630 (NB 7228) and 668 (NB 7226) are the key terrain features as they dominate the ULSTER River to the west and any avenues east or west from that area, including all of the major road networks.

(c) Avenues of Approach (AA): Three AAs have been identified in the division sector.

1 NORTH AA: Axis MARKSUHL, NB 846412, to BAD HERSFELD, NB 500351 to ALSFELD, NB 195224. (Division size.)

2 SOUTH AA: Axis DERMBACH, NB 790190, to HUNFELD NB 545137, to SCHLITZ, NB 398144 to GEDERN, NB 142682. (Division size.)

3 SOUTHWEST AA: Axis LAUTERBACH, NB 095285, to ALSFELD, NB 195224. (Regimental size.)

**APPENDIX B**  
**RATIONALE FOR SCORE ASSIGNMENT**

**1. TERRAIN FACTORS**

**1.1 FIELDS OF FIRE**

There is a direct parallelism between fields of fire and weather factors as pertains to observation. This category defines how far one can actually shoot. For example, a machine gun with a 1000 meter range, an optimum scenario is to be able to have grazing fire; that is, fire that is no higher than 6 feet above the ground. Natural cover such as folds in the ground can be covered by mortar fires. Therefore, the same parameters were used as the weather category - observation and visibility. The scores are also identical in a sense that in order to bring observed fire on to the OPFOR it is necessary to see them as well as have the appropriate fields of fire. As the ability to bring aimed fires onto an approaching force diminishes, the chance of attack is increased.

**1.2.1 Cover and Concealment into Friendly Sector**

The four subdivisions reasonably well define the possible conditions facing the friendly force commander. OPFOR will also have knowledge of these conditions since, doctrinally, each regimental sized force has a reconnaissance element which attempts to remain well forward of the main body and maintains continuous contact with friendly forces. Ignoring all other considerations, the OPFOR commander will be more amenable to a main thrust in an area with many covered/concealed routes of approach into the friendly forces sector than if there were no such advantage available. However, this battlefield characteristic has no real applicability for an OPFOR withdrawal.

### 1.2.2 Cover and Concealment about OPFOR Assembly Areas

Ideally, any force would desire total cover and concealment in and about an area bordering the FLOT. Such terrain would provide unobserved preparation for any type operation. Realistically, such terrain rarely exists. Therefore, the categories chosen only include areas that provide cover and concealment for 3 or more regimental assembly areas as a maximum. For this terrain the OPFOR can plan or organize for all four tactical modes. With fewer concealed areas it seems logical that a supporting attack or defensive posture would appear most appropriate. This is due to the fact that the terrain wouldn't lend itself to massing of forces for a main thrust; concurrently the withdrawal posture is slightly above the middle of the road. As cover and concealment decreases the OPFOR has less chance for massing without knowledge by the friendly forces. Therefore, defense becomes the best alternative. Withdrawal becomes a poor second with attack postures, with the requisite massing of force a poor third. Finally, in a tabletop environment none of the four operational postures is advantageous.

### 1.3.1 Mobility into and about Friendly Sector

In posturing the friendly forces, it would be a logical assumption that rear area trafficability was one of the evaluative factors in selecting a particular piece of terrain to occupy. Therefore, this category only addresses the terrain trafficability from the OPFOR FLOT into the friendly sector. In isolation, any terrain that provides a well established all weather road net and all weather cross-country trafficability is suitable for offensive operations. However, if such a trafficability pattern exists it will also allow the friendly forces to attack into the OPFOR zone. For such a case, a defensive posture is an extremely poor second choice and a withdrawal is no choice at all. The fair category still provides an offensive option, but would play better for a supporting attack. Defense and withdrawal are only marginally better than the previous terrain category. A poor terrain category would canalize the attacking force and therefore would best support



the defense. the OPFOR could also consider a withdrawal since the terrain would impede the friendly force advance and allow OPFOR to conduct a delay with minimum of force.

#### 1.3.2 Mobility about OPFOR Assembly Areas

If the terrain provides excellent mobility from the FLOT into the OPFOR sector then massing for an offensive thrust is as practical as maneuvering defensive forces within the battle area and as movement of forces rearward. Fair terrain trafficability would lessen the ability to mass but would support a secondary thrust or defense. A withdrawal would also be tactically feasible. A poor category eliminates the massing potential, limits maneuvering of defensive forces and, inhibits rearward movement.

#### 1.4 KEY FRIENDLY TERRAIN

If the friendly forces are occupying terrain which is by friendly terms critical to their operations then, if lost, it would require a change in friendly tactics. One can only assume that the OPFOR would also recognize this fact and attach some degree of importance to it also. As such, the OPFOR would attempt to deny the terrain to the friendly forces and therefore attempt to occupy it. Therefore an attack appears highly likely with defense a poor second and withdrawal out of the question. If the terrain is advantageous but not critical it would still behoove the OPFOR to deny its use to the friendly forces; but it may not critically play into the OPFOR operational plan. A limited objective attack might override a main thrust in this case. Defense may be an option as an economy of force role, but would be a poor second choice. Again, a withdrawal could not be substantiated. If the terrain is not key to the friendly forces, the OPFOR may select a secondary thrust to fix the friendly force in order to execute a main thrust at a more critical sector. OPFOR could also opt for defense. In this case, it has a lower weight because the OPFOR are offensive oriented and use defense as an economy of force measure. As in the previous sub-categories, Key Friendly Terrain

does not directly impact withdrawal.

### 1.5 OBSERVATION

If the friendly forces have the dominant terrain which would include overwatch and observation into OPFOR territory it would be wise for OPFOR to seek other areas for military operations. A withdrawal to more advantageous terrain would be the best choice. Defense would constitute a poor second choice and an attack, unless supported by other factors, constitutes a poorer third. If there is no apparent advantage in observation, defense would be the best bet but not that much better than an attack to fix the friendly forces or to ascertain their strength or will to fight. Such terrain would not merit the resources for a main thrust and a withdrawal would probably needlessly give up terrain. If the advantage of observation rests with OPFOR, then an attack of either type is the best tactic. Defense also has merit, for the OPFOR can observe the approach of the attacking friendly forces (if they attack). Under these circumstances I see no reason to select a withdrawal.

### 1.6 NATURAL/ARTIFICIAL OBSTACLES

If both sides have developed the battle area linking the natural obstacles with minefields and the like, the only practical option is defense for OPFOR. If the friendly forces have developed the area with obstacles and OPFOR has not, the situation does not lend itself to any tactical category; other factors will determine the most practical course of action. If the friendly forces have not developed obstacles and OPFOR has, then the OPFOR could either defend behind the obstacles or use them in preparation for offensive operations. Finally, if neither side has developed the battle area, one would assume maneuver by both sides. For OPFOR, attack would provide the best option, and considering no other factors, a main thrust would provide the highest payoff. Defense would provide a poor second choice since the OPFOR defensive template consist of well developed defensive bands. A withdrawal could also be considered; however the OPFOR would have little to delay an

offensive by the friendly forces.

## 2.1 CURRENT DISPOSITION

In facing a US Heavy Division, the OPFOR would consider a defense or supporting attack as a best option. In defense, OPFOR would blunt the offensive capability of the Heavy Division. In a secondary attack role, it would fix the friendly force. Without other considerations, a main thrust might require too many resources to defeat the friendly forces and a withdrawal would expose the OPFOR to the mobility of the Heavy Division. In opposing a light division (reinforced) the best option for OPFOR is offense with a main thrust slightly more favorable than a supporting attack. Defense could be a reasonable second choice; with withdrawal a poor third.

## 2.2 CONDITION AND STRENGTH

Under normal circumstances, friendly forces at 85% strength or better have approximately full combat power. At the 85% level the sustaining power is less than full strength. At approximately 30% these units are non-effective; fighting in small pockets of resistance with little or no cohesiveness. The numbers shown reflect this rationale. The weaker the friendly force, the more opportune the offensive action by OPFOR. For the US Light Division (reinforced), withdrawal is probably not a serious consideration.

## 2.3 SIZE OF CORPS RESERVE

Currently within the US Forces there is a shift from the active defense to the Air Land Battle concept. This new operational scheme not only fights the battle at the FEBA, but also anticipates combat in the enemy rear (deep strike) as well as behind the friendly forces positions. A friendly Corps with a division reserve can generate considerable offensive power and is a continuous threat to the OPFOR rear areas. As such, the OPFOR COA might tend

toward defense or a supporting attack to fix the friendly force with its large reserve. A very poor second choice would select a main thrust and a withdrawal would not be considered. A brigade reserve could still execute a deep strike, but with far less lethality than the previous case. Here, an attack would be a first choice with a secondary attack outweighing the primary attack. A second option would call for defense; a withdrawal would not be considered. Finally, if the Corps had no reserve, the choice would fall to a primary thrust or supporting attack with the former a slightly better option. Defense is an extremely poor second choice and again withdrawal is not considered.

#### 2.4 LOGISTICS SUPPORT OF MAJOR END ITEMS AND AMMO

If the logistics tail of the friendly forces is in good condition and can deliver replacement tanks, APC's, artillery and ammo to the engaged forces the OPFOR selection of defense would be well justified. A secondary attack could be a second choice - better than a main thrust - since it would present a less dense target environment. As friendly force support declines, the main thrust option becomes increasingly better. At the same time, the defense posture decreases in favor. Note that the secondary attack selection increases, but in the end would not provide the degree of success as the primary attack. This subcategory does not provide any indicators for withdrawal.

#### 2.5 MOST LIKELY FRIENDLY COA

If the friendly forces are attacking then the only course of action for OPFOR would be to initially defend. If the friendly forces intend to defend, then either attack mode would be selected for OPFOR with a very poor second choice for defense. If the friendly forces are withdrawing then the OPFOR should conduct a primary attack. A secondary attack would achieve far less but could still be considered. This subcategory does not consider withdrawal.

## 2.6 COMMAND AND CONTROL

If the friendly forces have good vertical and lateral  $C^2$ , the OPFOR could select to either attack or defend. The specific action would be based upon other factors. As friendly  $C^2$  progresses from good to bad the primary attack option becomes the best COA and a justification for defense diminishes. Note the supporting attack should be a slightly better option than the main thrust for friendly average  $C^2$  but is a distinct second for friendly bad  $C^2$ .

### 3.1.1.1 Total Number of Regiments

On the average, an OPFOR division contains four regiments. The Combined Arms Army has three motorized rifle regiments and one tank regiment while the Tank Army consists of three tank regiments and one motorized rifle regiment. There are of course variants of these configurations. In any particular sector (50+KMx50+KM) one could expect a maximum density of 12 regiments in several echelons. This compression signifies the massing of force for a main thrust. The fewer number of regiments would indicate other forms of military operations. According to doctrine, this massing effect is accomplished in a rapid manner. Therefore, if large numbers of regiments are detected, the massing for an offensive operation is probably underway. Again doctrinally the OPFOR would like to mass so that the bulk of the 1st echelon assault forces reach the friendly force positions at End Evening Nautical Twilight (EENT). OPFOR intend to conduct around the clock combat operations.

### 3.1.1.2 Number of Regiments in First Echelon

Continuing on the theme contained in 3.1.1.1, the regiments of 1st echelon divisions can be assigned sectors anywhere from 7 to 20 KM's. The physical occupation of assigned area is somewhat less. It would be appropriate to identify 4-6 1st echelon regiments in a 50x50 KM sector if OPFOR was to conduct a main thrust. Since one is never sure of OPFOR boundaries, a primary attack and secondary attack could occur in sector.

Other combinations could be secondary attack-defense, and defense-withdrawal. Such combinations as primary attack-withdrawal and to a lesser extent primary attack-defend would probably occur infrequently if at all.

#### 3.1.1.3 Number of Regiments in Second Echelon

The number of regiments in 2nd echelon, first divisions<sup>n</sup>, is indicative of the emphasis placed upon the operation about to commence (or in progress). If OPFOR senses the friendly forces are weak, more force will be massed in the forward assault/breakthrough, 1st echelon in hopes of quick results. However, the OPFOR planning for deliberate offensives places great store in the continued employment of force overtime. As lead elements are reduced to ineffectiveness, new units replace them (or so the doctrine goes) - thus the legend of steamroller tactics.

#### 3.1.1.4 Number of Tank Regiments

Soviets like armor and offensive doctrine is built around the tank, BMP, and BTR60. The tank regiment is normally in the 2nd echelon, 1st echelon division, as the arm to exploit the breakthrough. It is also used on the defense behind the second defensive belt to repulse any friendly forces breakthrough into the rear area. More recently, the separate tank regiment associated with the Army is reinforced with motorized rifle units, artillery and air defense to be employed in offensive operations. Once committed the Operational Maneuver Group (OMG)<sup>\*</sup> strikes deep into friendly forces territory to destroy C<sup>2</sup> functions, nuclear arsenals and other key targets. Tank units have been employed with 1st echelon forces when OPFOR perceives weakness within friendly forces.

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<sup>\*</sup> As we call it - probably they don't.

### 3.1.2 Bridging Material Placement

According to some unclassified sources, the OPFOR intend to bridge at least one major water obstacle per day (50KM advance). Therefore, friendly forces could expect bridging well forward with additional stockpiles of bridge materials for offensive operations. If bridging is distributed at bridge sites or what appear critical nodes, then a defensive operation may be considered. Distribution of bridge assets within the OPFOR sector would allow intrasector mobility. Some bridging well forward without added stockpiles indicates possible limited objectives into friendly forces territory. Bridging rearward would facilitate intrasector mobility implying a defense or withdrawal. Finally, no bridging in sector (or well rearward) would indicate a withdrawal. Normally nonessential equipment is withdrawn from sector to facilitate a rapid rearward movement.

### 3.1.3 Anti-Tank Unit Placement

In OPFOR doctrine anti-tank units are used in an economy of force role for offensive operations. For a main thrust these weapons systems are used to reinforce the flanks at the point of breakthrough. They are employed on the flanks of units prior to engagement for supporting attacks. In both cases, they relieve armor of a flank protection role. Defensively, the anti-armor units are employed in kill zones between the 1st and 2nd defensive belts. If found distributed along the FLOT it would indicate a reinforcement probably indicating more withdrawal than defense. Finally, if seen moving to the rear it would allude to movement to alternative positions; implying withdrawal operations.

### 3.1.4 Total Number of Artillery Battalions

Each motorized rifle regiment (MRR) has its own artillery battalion. Each division contains three additional battalions. The Chief of Rocket Troops and Artillery assigns assets as dictated by the tactical situation.

The division contains a division artillery group (DAG) and each MRR has a regimental artillery group (RAG) into which artillery battalions are assigned. Both Army and Front artillery assets are assigned down to 1st echelon divisions. Additionally the artillery units of 2nd echelon divisions can be assigned forward to support the forward elements. In a sector containing a main thrust 16+ battalions would represent the better part of 3 division equivalents supported by Army/Front assets. Something less would indicate a supporting attack followed by defense and withdrawal. 0 to 3 battalions would indicate a withdrawal was in progress and some units had already moved to alternative positions rearward.

#### 3.1.4.1 Number Located within 3-5KM

The RAGs are normally located 3-5 KMs from the FLOT. The higher the density the more likely OPFOR has selected an offensive operation. For defense, the artillery is located between the 1st and 2nd defensive belts; whereas, it is employed rearward for withdrawal operations to cover the movement of forward forces to alternate rearward positions.

#### 3.1.4.2 Number Located within 5-8KM

The DAG supports critical areas within the division sector. 6 or more battalions located in this area would indicate a main thrust; something less a secondary attack and at the lower spectrum a defense or withdrawal.

#### 3.1.4.3 Number Located within 8-30KM

A large number of artillery units in this sector would indicate defensive operations; something less would indicate a withdrawal. With few numbers of units in this area one could assume offensive operations and attribute these units to second echelon divisions (or moving forward to support an attack).



#### 3.1.4.4 Number Located within 30-50KM

Several artillery units found here would indicate support for a withdrawal. No units in sector would indicate either no forces are in sector (not considered) or the units were closer to the FLOT indicating offense or defense.

#### 3.1.5 Number of SAM Batteries

The divisional SAM consist of SA6's and SA8's. While SA6's are employed by batteries (5 per division), SA8's are employed by half batteries (10 pairs per division). By ELINT identification procedures, the actual SA8 configuration on the battlefield could be in doubt. Therefore, the pairwise employment is the best assumption. 15 or more separate SAM ELINT identifications would indicate an attack. Lesser numbers would point to defense; while even fewer numbers would imply withdrawal.

#### 3.1.6 Operational Maneuver Group (DMG) Present

The OMG is built around the independent tank regiment of the Army. It is augmented with motorized infantry, artillery and SAM batteries. As pointed out earlier, the OMG is committed once a breakthrough has occurred. It drives deep into friendly forces territory to destroy critical installations. Since the friendly forces rarely know the OPFOR boundaries it is extremely difficult to ascertain the OMG area of employment within the Army sector. Therefore, if the friendly force is doing much better than its adjacent units it is probable that the OMG will not be employed in sector; doctrine dictates that a probable supporting attack will occur. If the friendly forces sector and flanks are doing equally well or somewhat better then it is difficult to ascertain what type of offensive action (primary/secondary attack) is occurring. If doing worse, it is highly likely the primary attack is in sector and the OMG will be committed.

### 3.2 CONDITION AND STRENGTH TIED TO NUMBER OF OPFOR REGIMENTS

The concept here is to tie numbers of regiments and their strength in combat power to a specific type combat operation. The assumption is that units at 85% strength or better can fight as fully equipped units. As the strength decreases the combat power is eroded - slowly at first - until at 30% strength the cohesiveness is gone. A large number of strong regiments would indicate offensive operations. From here it is a balancing act equating fewer full up regiments to many weaker regiments. One of the nice things about OPFOR regiments is that they do not rebuild on line. Depleted units are withdrawn and consolidated into new regiments in the rear.

### 3.3 TANKS IN 25-50KM BAND

This subcategory is not very sensitive to operational type. However, the absence of armor leans strongly in favor of a withdrawal. As such, the armor probably has been withdrawn to be applied elsewhere. A withdrawal is an economy of force measure that allows massing of combat power at a more decisive sector.

#### 3.4.1 Artillery Movement

This subcategory provides an indication of combat momentum. Artillery units moving toward the FLOT would imply offensive activity. On the other hand, moving rearward would indicate (strongly) a withdrawal operation and to a lesser extent a defense where forces are being moved to alternate firing positions. No movement is not indicative of anything.

#### 3.4.2 Service Unit Movement

This subcategory is a blueprint of the previous one. Forward movement indicates offensive momentum; rearward movement - defense or withdrawal. OPFOR doctrine does not provide for evacuation of damaged equipment from the

battlefield. As OPFOR moves forward damaged equipment, left in place, is recovered and repaired.

### 3.5.1 Army Operations Post in Sector

Doctrine dictates that commanders of all levels be well forward to influence the combat outcome. Regimental commanders may have operations posts (OP) well forward of battalion command posts (CP). If an Army OP is found in sector it will probably be located forward of the division main CP possibly collocated with the division forward CP. In such cases offensive operations will probably occur with emphasis on a main thrust. If the Army OP is not found in sector a poor logical outcome would infer defense, withdrawal or secondary attack in that order.

### 3.5.2 Number of Division Command Posts (CP) in Sector

This subcategory provides an indicator of massing of forces. Usually the C<sup>2</sup> function is installed prior to execution of an operations plan. Three CP's in sector is a definite indicator of offensive intent. The potential massing of force could reach 12 regiments (over time). As the number of CPs becomes fewer, less definite information can be ascribed to the indicator. However, in the extreme case of no CP's in sector, a weak assumption of withdrawal can be inferred.

## 3.6 DOES OPFOR HAVE LOCALIZED AIR SUPERIORITY

Offensive ground operations require local air superiority if it is to be sustained for any appreciable amount of time. A localized attack at night can be successful without air superiority. Daylight operations without it are very risky. In fact, forward or rearward movement requires some degree of offensive/defensive air cover.

#### 4.1 OBSERVATION AND VISIBILITY

This subcategory and Fields of Fire subcategory are conceptually very similar. See 1.1 Fields of Fire for rationale.

#### 4.2 MOBILITY DUE TO WEATHER

If the terrain trafficability allows maneuver at average speeds of 10 KPH then OPFOR should conduct offensive operations. Both attack options are equally acceptable. A defense or withdrawal should not be considered since the terrain is equally good for friendly forces. If the terrain is susceptible to weather factors, other considerations should determine the selected tactic. However, defense provides the best risk free option in this case with a well planned withdrawal a reasonable second. Offensive operations would require considerable support from other factors such as weather. If the terrain is impassible due to weather, defense is the best option; withdrawal a poor second and offense should not be considered.

#### 5.1 FRIENDLY ACTION/REACTION CAPABILITY

If the friendly forces are capable of reacting to OPFOR tactics, then a supporting thrust would fix these friendly forces for OPFOR successes elsewhere. An OPFOR defense in this situation would give the initiative to the friendly forces. A withdrawal would not serve a purpose since the OPFOR could not disengage to reorganize. On the other hand if friendly forces cannot react, any penetration of those forces could pay handsome dividends. A defense or withdrawal should be out of consideration.

##### 5.2.1 Possible Attack Along Friendly's Line of Least Expectation

There are many, many classical examples of these operations. The Ardennes offensive in 1940 is a point in case as is the Pusan amphibious invasion circa 1950. If the OPFOR has the force and the planning capability

to play this role it would pay handsome dividends. Otherwise a moderate aggressive act or defense could be expected.

#### 5.2.2 Is OPFOR Using Deception

It is unlikely that OPFOR would attempt deception to represent defensive operations. The defense requires considerable préparation for positions, obstacles and the like and has distinct signatures. Rather, OPFOR should attempt to indicate an attack when a defense or withdrawal are planned. By doing this, OPFOR can concentrate forces elsewhere. If no deception is used the subcategory provides no indicator of activity.

#### 5.3 RISK OF UNEXPECTED SEVERE WEATHER BETWEEN 4 TO 8 HOURS

The OPFOR use analytical procedures to validate selected tactical maneuvers. Severe weather would delay offensive operations; in fact, delay movement of any type unless limited objectives were desired. Otherwise no risk of severe weather has no impact on operations.

SCORES GIVEN TO FOUR ECOAS  
for

1.0 TERRAIN FACTORS

	Primary Attack	Secondary Attack	Defense	Withdrawal
1.1 Fields of Fire				
Greater than 3000 meters	10	40	100	0
Between 1500 and 3000 meters	80	90	90	50
Less than 1500 meters	100	100	30	60
1.2.1 Cover and Concealment Into Friendly Sector				
Many (3 or more) Totally Covered and Concealed Routes	100	80	0	0
Few (1 or 2) Totally Covered and Concealed Routes	50	90	30	0
Partially Covered and Concealed Routes	30	70	50	0
No Covered and Concealed Routes	0	10	100	0
1.2.2 Cover and Concealment About OPFOR Assembly Areas				
Many (3 or more) Totally Covered and Concealed assembly Areas	100	100	100	100
Few (1 or 2) Totally Covered and Concealed Assembly Areas	40	80	80	60
Partially Covered Assembly Areas	20	40	70	50
No Covered Assembly Areas	0	0	0	0

SCORES GIVEN TO FOUR ECOAS  
for  
1.0 TERRAIN FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
<p>1.3.1 Mobility (i.e., Road-Nets and off-road trafficability) into and about Friendly Sector</p> <p>Excellent (dense road network, i.e., a road about every km; all-weather roads, i.e., concrete, asphalt, or rock stabilized; and/or can drive very well off-road)</p> <p>Fair (road about every 2 to 3 km on average; and/or off-road trafficability limited by prolonged rain or snow)</p> <p>Poor (very few roads; roads are poor quality, i.e., typically seasonal and no off-road trafficability)</p> <p>1.3.2 Mobility About OPFOR Assembly Areas</p> <p>Excellent</p> <p>Fair</p> <p>Poor</p>	<p>100</p> <p>80</p> <p>0</p> <p>100</p> <p>40</p> <p>0</p>	<p>90</p> <p>100</p> <p>20</p> <p>100</p> <p>80</p> <p>0</p>	<p>20</p> <p>40</p> <p>100</p> <p>100</p> <p>80</p> <p>40</p>	<p>0</p> <p>10</p> <p>60</p> <p>100</p> <p>70</p> <p>40</p>

SCORES GIVEN TO FOUR ECOAS  
for

1.0 TERRAIN FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
1.4 KEY FRIENDLY Terrain				
Yes; terrain is critical to friendly operations	100	60	20	0
Yes; terrain is advantageous but not critical to friendly operations	60	80	40	0
No key terrain	40	80	60	0
1.5 OBSERVATION (Due to Physical Elevation) from Friendly to OPFOR Friendly Advantage (Dominant Terrain; friendly can look down on OPFOR)	10	20	40	100
No Advantage (equal height)	40	60	80	20
Friendly has Disadvantage	100	100	60	0
1.6 Natural/Artificial Obstacles (that canalize the force)				
Friendly Side: Yes; OPFOR Side: Yes	0	0	100	0
Friendly Side: Yes; OPFOR Side: No	0	0	0	0
Friendly Side: No; OPFOR Side: Yes	50	70	90	0
Friendly Side: No; OPFOR Side: No	100	70	40	20



SCORES GIVEN TO FOUR ECOAS  
for  
2.0 FRIENDLY FORCE FACTORS

	Primary Attack	Secondary Attack	Defense	Withdrawal
<p><u>2.1 Current Disposition</u></p> <p>U.S. Heavy Division (Armor/Mech Division)</p> <p>Light Division (Infantry with alittle armor)</p>	<p>40</p> <p>80</p>	<p>70</p> <p>70</p>	<p>100</p> <p>50</p>	<p>30</p> <p>10</p>
<p><u>2.2 Condition and Strength</u></p> <p>If U.S. Heavy Division</p> <p>85% Strength</p> <p>75 - 84% Strength</p> <p>50 - 74% Strength</p> <p>30 - 49% Strength</p> <p>If U.S. Light Division</p> <p>85% Strength</p> <p>75 - 84% Strength</p> <p>50 - 74% Strength</p> <p>30 - 49% Strength</p>	<p>40</p> <p>50</p> <p>70</p> <p>100</p> <p>80</p> <p>90</p> <p>100</p> <p>100</p>	<p>70</p> <p>70</p> <p>80</p> <p>90</p> <p>70</p> <p>80</p> <p>90</p> <p>100</p>	<p>100</p> <p>90</p> <p>50</p> <p>30</p> <p>50</p> <p>40</p> <p>20</p> <p>0</p>	<p>30</p> <p>25</p> <p>10</p> <p>0</p> <p>0</p> <p>0</p> <p>0</p> <p>0</p>

**SCORES GIVEN TO FOUR ECOAS  
for**

**2.0 FRIENDLY FORCE FACTORS (cont.)**

	Primary Attack	Secondary Attack	Defense	Withdrawal
<b>2.3 Size of Corps Reserves</b>				
Division	30	90	100	0
Brigade	60	100	40	0
None	100	90	10	0
<b>2.4 Logistic Support of Major End Items and Ammo</b>				
Good	40	70	100	0
Average	70	80	50	0
bad	100	90	30	0
<b>2.5 Most Likely Friendly COA</b>				
Attack	0	0	100	0
Defense	80	80	20	0
Withdrawal	100	70	0	0
<b>2.6 Command and Control</b>				
Good	50	50	50	0
Average	60	70	50	0
Bad	100	80	30	0

SCORES GIVEN TO FOUR ECOAS  
for

3.0 OPFOR FORCE FACTORS

	Primary Attack	Secondary Attack	Defense	Withdrawal
3.1.1.1. Total Number of Regiments				
12	100	0	0	0
11	90	0	0	0
10	75	0	0	0
9	60	0	0	0
8	40	65	0	0
7	20	80	0	0
6	0	100	30	0
5	0	65	65	0
4	0	0	100	40
3	0	0	75	60
2	0	0	0	100
1	0	0	0	0
0	0	0	0	0
3.1.1.2 Number of Regiments in First Echelon				
6	100	0	0	0
5	80	0	0	0
4	50	50	0	0
3	0	100	30	0
2	0	40	100	50
1	0	0	0	100
0	0	0	0	0

# SCORES GIVEN TO FOUR ECOAS

for

## 3.0 OPFOR FORCE FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
3.1.1.3 Number of Regiments in Second Echelon				
6	100	0	0	0
5	95	0	0	0
4	60	40	0	0
3	0	100	60	0
2	0	60	100	30
1	0	0	0	100
3.1.1.4 Number of Tank Regiments				
5	100	0	0	0
4	90	0	0	0
3	75	30	0	0
2	0	100	40	0
1	0	95	100	30
0	0	0	0	100
3.1.2 Bridging Material Placement				
Bridging employed forward plus lots of additional units	100	20	0	0
Distributed in sector at critical nodes	60	40	100	20
Bridging forward employed	30	100	0	0
Bridging well rearward	0	0	40	40
No bridging in sector	0	0	10	100

# SCORES GIVEN TO FOUR ECOAs

for

## 3.0 OPFOR FORCE FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
3.1.3 Anti-Tank Unit Placement				
Units Moving Forward	100	50	10	0
Employed Flank Forward	50	100	0	0
Grouped in 3-30 km Kill Zones	0	0	100	50
Uniformly distributed along F Lot	0	20	40	80
Moving Rearward	0	0	40	100
3.1.4.1 Total Number of Artillery Battalions				
16 to 21	100	0	0	0
12 to 15	75	65	0	0
10 to 11	30	100	20	0
8 to 9	0	60	40	20
6 to 7	0	40	100	50
4 to 5	0	30	30	100
0 to 3	0	30	20	
3.1.4.2.1 No. Located within 3-5 km				
12 to 15	100	0	0	0
9 to 11	75	40	0	0
4 to 8	40	100	0	0
2 to 3	0	0	100	20
0 to 1	0	0	60	100

SCORES GIVEN TO FOUR ECOAS  
for

3.0 OPFOR FORCE FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
3.1.4.2.2 No. Located within 5-8 km				
6 to 7	100	40	0	0
3 to 5	50	100	0	0
1 to 2	0	30	30	0
0	0	0	100	100
3.1.4.2.3 No. Located within 8-30 km				
8 to 9	0	0	80	0
6 to 7	0	20	100	100
4 to 5	30	40	50	65
0 to 3	100	100	10	30
3.1.4.2.4 No. Located within 30-50 cm				
2 to 3	0	0	0	100
1	0	10	75	75
0	100	100	100	50
3.1.5 Number of SAM Batteries (Assumption: Do not know type)				
21	100	0	0	0
15 to 20	80	60	30	0
11 to 14	60	100	45	0
8 to 10	30	60	100	45
5 to 7	0	30	60	100
4	0	0	30	45

SCORES GIVEN TO FOUR ECOAS  
for

3.0 OPFOR FORCE FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
3.1.6 Operational Maneuver Group Present				
Yes, and sector facing OPFOR doing much better than flanks	50	100	0	0
Yes, and sector facing OPFOR doing somewhat better to somewhat worse than flanks	75	75	0	0
Yes, and sector facing OPFOR doing much worse than flanks	100	50	0	0
No	0	0	0	0
3.2 Condition and Strength tied to Number of OPFOR Regiments				
o If Number of Regiments is 9 to 12 and Average Strength is				
85%	100	60	40	10
75 to 85%	90	100	20	20
50 to 74%	50	70	100	30
30 to 49%	20	40	80	100
o If Number of Regiments is 6 to 8 and Average Strength is				
85%	60	100	30	0
75 to 85%	40	90	70	20
50 to 74%	20	40	100	60
30 to 49%	0	20	50	100

SCORES GIVEN TO FOUR ECOAS  
for

3.0 OPFOR FORCE FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
o If Number of Regiments is 3 to 5 and Average Strength is				
85%	0	50	100	30
75 to 85%	0	30	90	50
50 to 74%	0	0	40	70
30 to 49%	0	0	0	100
o If Number of Regiments is 0 to 2 and Average Strength is				
85%	0	0	0	100
75 to 85%	0	0	0	100
50 to 74%	0	0	0	100
30 to 49%	0	0	0	100
B-26				
3.3 Tanks in 25 - 50 km Band?				
Yes	100	100	100	0
No	0	30	70	100
3.4.1 Artillery Movement				
Moving Forward	100	100	30	0
Not Moving	0	0	0	0
Moving Rearward	0	0	50	100
3.4.2 Service Unit Movement				
Moving Forward	100	100	30	0
Not Moving	0	0	0	0
Moving Rearward	0	0	100	100



SCORES GIVEN TO FOUR  
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3.0 OPFOR FORCE FACTORS (cont.)

	Primary Attack	Secondary Attack	Defense	Withdrawal
3.5.1 Army Operations Post in Sector?				
Yes	100	50	0	0
No	0	20	50	30
3.5.2 Number of Division Command Posts in Sector				
3	100	50	0	0
2	50	100	20	0
1	0	100	100	50
0	0	0	0	40
3.6 Does OPFOR have localized Air Superiority?				
Yes	100	90	40	10
No	0	70	100	20

SCORES GIVEN TO FOUR ECOAS  
for

4.0 WEATHER FACTORS

	Primary Attack	Secondary Attack	Defense	Withdrawal
4.1 Observation and Visibility/Cover and Concealment due to weather (along ground and above ground)				
Greater than 3000 meters	10	40	100	0
1500 to 3000 meters	80	90	90	50
Less than 3000 meters	100	100	30	60
4.2 Mobility due to Weather				
Roads and countryside traversable at 10 km/hr.	100	100	0	0
Roads and countryside traversable at 0 to 10 km/hr.	20	20	60	40
Roads and countryside not traversable due to weather	0	0	100	100

SCORES GIVEN TO FOUR ECOAS  
for

5.0 RISK FACTORS

	Primary Attack	Secondary Attack	Defense	Withdrawal
5.1 Friendly Action/Reaction Capability?  Yes No	70 100	100 70	50 0	30 0
5.2.1 Possible Attack along Friendly's Line of Least Expectation  Yes No	100 0	70 50	0 70	0 0
5.2.2 Is OPFOR Using Deception?  Yes No	0 0	0 0	100 0	60 0
5.3 Risk of Unexpected Severe Weather between 4 to 8 hours?  Yes No	20 0	50 0	100 0	50 0

**SCORES GIVEN IN AVENUE OF APPROACH (AOA) EVALUATION  
TO ASSESS PRIMARY ATTACK AND SECONDARY ATTACK CORRIDORS**

**1.0 TERRAIN FACTORS**

	<b>PRIMARY ATTACK</b>	<b>SECONDARY ATTACK</b>
<b>1.1 Fields of Fire</b>		
Greater than 3000 meters	10	40
Between 1500 and 3000 meters	80	90
Less than 1500 meters	100	100
<b>1.2.1 Cover and Concealment Into Friendly Sector</b>		
Many (3 or more) Totally Covered and Concealed Routes	100	80
Few (1 or 2) Totally Covered and Concealed Routes	50	90
Partially Covered and Concealed Routes	30	70
No Covered and Concealed Routes	0	10
<b>1.2.2 Cover and Concealment About OPFOR Assembly Areas</b>		
Many (3 or more) Totally Covered and Concealed assembly Areas	100	100
Few (1 or 2) Totally Covered and Concealed Assembly Areas	40	80
Partially Covered Assembly Areas	20	40
No Covered Assembly Areas	0	0
<b>1.3.1 Mobility (i.e., Road-Nets and off-road trafficability) into and about Friendly Sector</b>		
Excellent (dense road network, i.e., a road about every km; all-weather roads, i.e., concrete, asphalt, or rock stabilized; and/or can drive very well off-road)	100	90
Fair (road about every 2 to 3 km on average; and/or off-road trafficability limited by prolonged rain or snow)	80	100

	PRIMARY ATTACK	SECONDARY ATTACK
1.3.1 (cont.)		
Poor (very few roads; roads are poor quality, i.e., typically seasonal and no off-road trafficability)	0	20
1.3.2 Mobility About OPFOR Assembly Areas		
Excellent	100	100
Fair	40	80
Poor	0	0
1.4 KEY FRIENDLY Terrain		
Yes; terrain is critical to friendly operations	100	60
Yes; terrain is advantageous but not critical to friendly operations	60	80
No key terrain	40	80
1.5 OBSERVATION (Due to Physical Elevation) from Friendly to OPFOR Friendly Advantage (Dominant Terrain; friendly can look down on OPFOR)	10	20
No Advantage (equal height)	40	60
Friendly has Disadvantage	100	100
1.6 Natural/Artificial Obstacles (that canalize the force)		
Friendly Side: Yes; OPFOR Side: Yes	0	0
Friendly Side: Yes; OPFOR Side: No	0	0
Friendly Side: No; OPFOR Side: Yes	50	70
Friendly Side: No; OPFOR Side: No	100	70

SCORES GIVEN IN AVENUE OF APPROACH (AOA) EVALUATION  
TO ASSESS PRIMARY ATTACK AND SECONDARY ATTACK CORRIDORS

2.0 FRIENDLY FORCE FACTORS

		PRIMARY ATTACK	SECONDARY ATTACK
2.1	<u>Current Disposition</u>		
	U.S. Heavy Division in Sector	40	70
	U.S. Light Division in Sector	80	70
2.2	<u>Condition and Strength</u>		
	If Heavy Division:		
	85% Strength	40	70
	75 - 84% Strength	50	70
	50 - 74% Strength	70	80
	30 - 49% Strength	100	90
	If Light Division:		
	85% Strength	80	70
	75 - 84% Strength	90	80
	50 - 74% Strength	100	90
	30 - 49% Strength	100	100

**SCORES GIVEN IN AVENUE OF APPROACH (AOA) EVALUATION  
TO ASSESS PRIMARY ATTACK AND SECONDARY ATTACK CORRIDORS**

**3.0 OPFOR FORCE FACTORS**

	PRIMARY ATTACK	SECONDARY ATTACK
<b>3.1.1.1 Total Number of Regiments in AOA</b>		
4 or more in AOA	100	30
3	90	60
2	60	90
1	0	30
<b>3.1.1.2 Number of Tank Regiments in AOA</b>		
3	100	30
2	90	60
1	75	95
0	20	40
<b>3.1.2 Bridging Material Placement</b>		
Bridging employed forward plus additional units	100	20
Distributed in sector at critical nodes	60	40
Bridging forward employed	30	100
<b>3.1.3 Anti-Tank Unit Placement</b>		
Units Moving Forward	100	50
Employed Flank Forward	50	100
<b>3.1.4.1 Total Number of Artillery Battalions</b>		
10 to 11	100	60
8 to 9	75	75
6 to 7	50	100
4 to 5	20	60
0 to 3	0	0

### 3.1.4.2.1 No. Located within 3-5 km

6 to 8	100	50
3 to 5	40	60
0 to 2	0	0

### 3.1.4.2.2 No. Located within 5-8 km

3 to 4	100	40
1 to 2	50	100
0	0	0

### 3.1.5 Number of SA6 Batteries

15 to 21	100	30
10 to 14	80	50
6 to 9	30	80
1 to 5	10	100
0	0	0

### 3.1.5.1 Number of SA7 Batteries

15 to 21	100	30
10 to 14	80	50
6 to 9	30	80
1 to 5	10	100
0	0	0

### 3.1.5.2 Number of SA8 Batteries

15 to 21	100	30
10 to 14	80	50
6 to 9	30	80
1 to 5	10	100
0	0	0

### 3.1.6 Operational Maneuver Group Present

Yes, and sector facing OPFOR doing much better than flanks	50	100
Yes, and sector facing OPFOR doing somewhat better to somewhat worse than flanks	75	75
Yes, and sector facing OPFOR doing much worse than flanks	100	50
No	0	0



### 3.2 Condition and Strength tied to Number of OPFOR Regiments

- o If Number of Regiments is 3 to 5 and Average Strength is

85%	100	60
75 to 85%	90	100
50 to 74%	50	70
30 to 49%	20	40

- o If Number of Regiments is 2 to 3 and Average Strength is

85%	60	100
75 to 85%	49	90
50 to 74%	20	40
30 to 49%	0	20

- o If Number of Regiments is 1 to 2 and Average Strength is

85%	0	50
75 to 85%	0	30
50 to 74%	0	0
30 to 49%	0	0

#### 3.3.1 Army Operations Post in Sector?

Yes	100	50
No	0	20

#### 3.4 Does OPFOR have localized Air Superiority?

Yes	100	90
No	0	70

**SCORES GIVEN IN AVENUE OF APPROACH (AOA) EVALUATION  
TO ASSESS PRIMARY ATTACK AND SECONDARY ATTACK CORRIDORS**

**4.0 WEATHER FACTORS**

	<b>PRIMARY ATTACK</b>	<b>SECONDARY ATTACK</b>
<b>4.1 Observation and Visibility/Cover and Concealment due to weather (along ground and above ground)</b>		
Greater than 3000 meters	10	40
1500 to 3000 meters	80	90
Less than 1500 meters	100	100
<b>4.2 Mobility due to Weather</b>		
Roads and countryside traversable at 10 km/hr.	100	100
Roads and countryside traversable at 0 to 10 km/hr.	20	20
Roads and countryside not traversable due to weather	0	0